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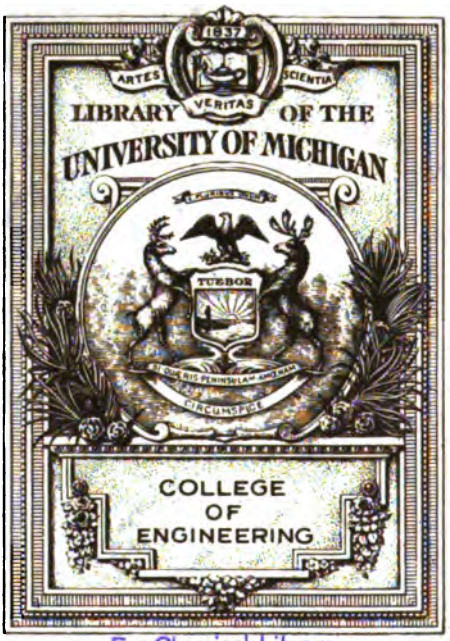

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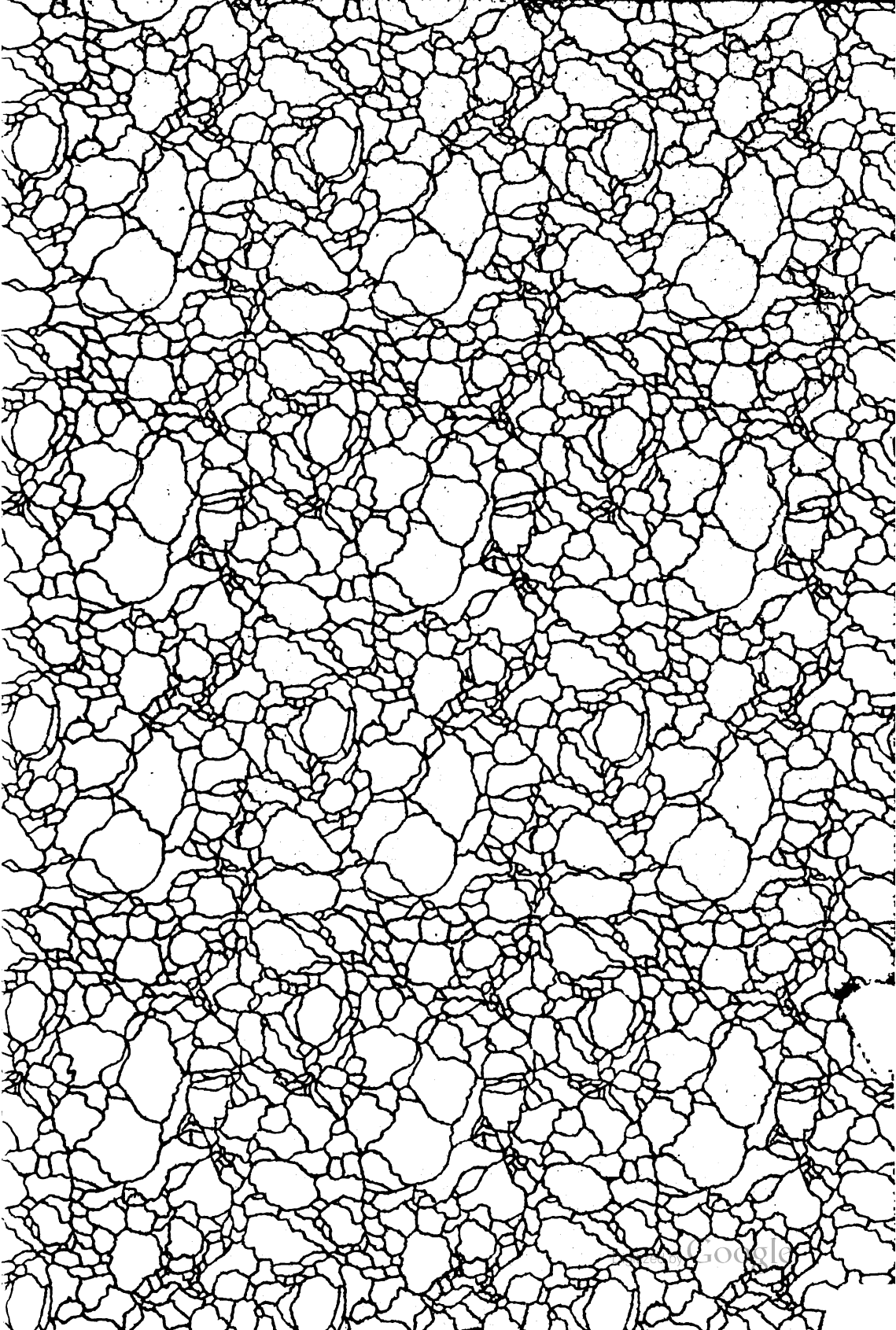
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PROCEEDINGS

OF THE

Natural Gas Association of America

THIRTEENTH ANNUAL MEETING

HELD AT

The Chamber of Commerce, Pittsburgh, Pa.

May 22nd and 23rd, 1918

Published by the Association
Edited by the Secretary.

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THIRTEENTH ANNUAL MEETING

OF THE

Natural Gas Association of America

HELD

MAY 22nd and 23rd, 1918

PROCEEDINGS

FIRST DAY — MORNING SESSION.

WEDNESDAY, MAY 22, 1918.

The Thirteenth Annual Meeting of the Natural Gas Association of America convened at the Chamber of Commerce, Pittsburgh, Pa., at ten o'clock, A. M., Wednesday, May 22nd, 1918, with Joseph F. Guffey, Pittsburgh, Pa., as President, and Thomas C. Jones, of Delaware, Ohio, as Secretary.

The following members reported their attendance:

ADAMS, LARMOUR
ALBERTY, P. A.
AMEL, L. C.
APPLEGATE, H. L.
ARMSTEAD, DANIEL M.
ARMSTRONG, A. A.
ARNOLD, W. H.
ARRAS, W. H.
AYER, J. W.
BARGAR, L. F.
BARTLETT, E. O.
BARTLETT, JOHN C.
BARTLETT, R. H.
BARTLEY, E. L.
BATCHELOR, G. F.
BATDORF, E. D.
BAXTER, W. C.
BEARDSLEY, R. D.
BEATTY, E. C.
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WALSH, MAURICE W.
WALTON, J. D.
WATTS, HARRY P.
WAY, W. B.
WEARING, G.
WERNER, E. M.
WEST, OLANDUS
WESTCOTT, HENRY P.
WEYMOUTH, THOMAS R.
WICKETT, GORDON
WILSON, HENRY M.
WITTMER, GEORGE
WHITCOMB, E. C.
WHITCOMB, E. P.

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WHITE, DAVID
WHITE, DR. I. C.
WHITELEY, WM. H.
WONDERLEY, W. V.
WOODWARD, W. L.
WOODWORTH, R. B.
WYER, S. S.
YORKE, PATRICK
YOUNG, WILLIAM T.
ZELLER, S. E.
ZIMMERMAN, C. W.

PRESIDENT GUFFEY: Gentlemen, it gives me great pleasure to call together the Thirteenth Annual Meeting of the Natural Gas Association of America. We are trying this year to do in two days what previously we have attempted to accomplish in three or four days and in order to assist in this campaign of "conservation" we have decided to omit three things: First the Address of Welcome (and I am sure you all know that you are welcome); the second is the Response to the Address of Welcome and the third is the Address of the President.

We will now proceed with the regular order of business and the first report to be made is the report of the Board of Directors as submitted by Secretary Jones.

Mr. T. C. Jones then read the following:

REPORT OF BOARD OF DIRECTORS.

PITTSBURGH, PA., May 22, 1918.

To the Natural Gas Association of America:

GENTLEMEN: — Your Board of Directors beg leave to submit the following report:

During the past year, four meetings of your Board of Directors were held in Pittsburgh. At the first meeting of the Board after the Buffalo convention, held on July 10th, the War Service Committee — consisting of

John G. Pew,
George W. Crawford,
J. C. McDowell,
Glenn T. Braden,
W. Y. Cartwright,
Joseph F. Guffey as Chairman,

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was appointed; and David O. Holbrook selected as Secretary of the Committee.

The Finance Committee, consisting of

K. C. Krick as Chairman,
A. A. Armstrong,
J. H. Maxon,

to have charge of the finances of the Association, was appointed.

* * *

At the meeting held on December 1, 1917, communication was read advising that Louisville would be unable to entertain the convention in accordance with the plans as originally outlined, and it was decided to change the place of meeting to Pittsburgh and to hold only a two-day convention. The question of having the usual display of appliances was gone into thoroughly, and — because of traffic conditions and for other good reasons — it was deemed advisable to suggest to the Supply Men's Association that the exhibit feature be omitted this year.

At the meeting March 4, 1918, the program for the present convention was arranged. The question of the deduction from gas companies' invoices because of low pressure was thoroughly discussed.

Your Board of Directors also beg leave to submit for your consideration the following recommendations and report:

Nominating Committee: W. Y. Cartwright, Arthur Booth and A. A. Armstrong.

Committee on Next Place of Meeting: W. J. Broder, L. Adams, L. A. Seyffert.

Committee on Memorials: Milt H. Saul, L. S. Bigelow and D. S. Wakenight.

That the following be RELEASED FROM MEMBERSHIP at their own request: Walter Abbe, Jr., I. H. Atkins, Cameron Brown, W. N. Baker, T. M. Black, R. E. Boothe, J. F. Bulger, Gordon M. Campbell, Gail Carey, G. N. Clapp, R. R. Crowe, J. C. Cunningham, W. B. Davies, Merrill N. Davis, H. Alexander Dean, C. R. Dietrich, V. L. Elbert, George J. Fischer, Robert W. Goodnow, C. M. Hester, H. C. Hoagland, Lynn Holbrook, Norwood John-

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ston, Paul R. Johnson, L. D. Irkard, J. W. Kelly, R. L. Kidner, Frank Knapp, J. W. Kitchen, T. L. Lewis, F. A. Leovy, N. C. McClellan, C. F. Mason, J. Wylie Mitchell, E. Burt Nutt, W. L. Oakes, George G. Oberfell, John F. Parker, A. I. Payne, N. W. Reed, George L. Ratcliffe, W. Reul, W. A. Robertson, Edward H. Rodgers, Robert Seeger, H. S. Sladen, R. M. Snyder, Jr., L. S. Thomson, W. A. Wadsworth, S. H. Wheelhouse, A. L. Wilkinson, George Yardley, R. A. Zeigler, W. L. Brown, R. B. Crawford, Eugene Daily, W. J. Doty, R. G. Dreher, H. E. Hall, F. C. Hanchett, V. H. Lytle, B. A. Magrew and G. H. Reckard.

That the following be dropped from Membership for Non-Payment of Dues: S. W. Bowman, A. E. Boyd, W. H. Buckley, H. H. Church, G. H. Caffrey, D. W. Cork, W. H. Filler, J. C. Ford, D. H. Foster, F. M. Gilmore, W. S. Guitteau, D. K. James, F. G. Jackson, P. C. Jacobs, J. T. Kent, F. J. Louis, H. E. Manley, J. H. McDermott, B. L. Miller, Robert Munro, D. B. Riggs, E. Robinson, Jr., C. O. Rockwell, G. W. Russell, R. S. Shade, A. Silva, K. H. Bane, J. A. Doherty, J. S. Hatfield, F. B. Haymaker, W. W. Hill, W. A. Wall, L. D. Wells, Grant West, J. W. Wilson, G. W. Barnes, A. M. Ballard, J. M. Bridges, Glen Gale, B. J. Grammel, A. L. Hastings, Samuel Redic, W. J. Rodgers, V. W. Storey and A. D. Fyfe.

Respectfully submitted for the Board of Directors,

JOSEPH F. GUFFEY, *President,*
THOMAS C. JONES, *Secretary.*

PRESIDENT GUFFEY: Gentlemen, you have heard the Report of the Board of Directors as submitted through our Secretary. What is your wish in the matter?

MR. FRANK R. HUTCHINSON: Mr. President, I move that the report of the Board of Directors as submitted be received, ordered placed on file and spread upon the minutes of the Association.

DR. I. C. WHITE: I second the motion, Mr. President.

And thereupon the above motion having been duly seconded, was carried and the report of the Board of Directors was ordered received, filed and spread upon the minutes of the Association.

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PRESIDENT GUFFEY: The next committee to report will be the Committee on New Members.

MR. FRANK R. HUTCHINSON: Mr. President, in the absence of the Chairman of this Committee, I have been requested to submit the report of the Committee on New Members.

And thereupon there was then submitted, verbally, the following:

REPORT OF COMMITTEE ON NEW MEMBERS.

Mr. President and Members of the Natural Gas Association of America:

Your Committee begs leave to report that it has placed in the hands of our Secretary a list of applications for membership to the number of fifty-four. These applications, having been duly approved, the Committee recommends the election of each applicant to full membership in this Association.

PRESIDENT GUFFEY: Gentlemen, you have heard the report of the Committee on New Members; if there are no objections to any of the members proposed the Chair will now entertain a motion that the Secretary cast the ballot of the Association for the election to membership in the Association of each and all of the applicants recommended in this report.

MR. EDWIN ROBINSON: Mr. President, I move that the report of the Committee on New Members be received, accepted and placed on file and that the Secretary be directed to cast the ballot of the Association for the election to membership in the Association of the applicants recommended in this report.

MR. FRANK R. HUTCHINSON: I second the motion.

And thereupon said motion, having been duly seconded, was unanimously adopted.

Secretary Jones then cast the ballot of the Association for the election to membership of the applicants whose names were recommended by said Committee and said applicants were duly declared members of the Association and were invited to join in the discussions and to participate in the proceedings.

The list of applicants recommended and elected to membership in the Association is as follows:

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NEW MEMBERS.

H. L. Applegate, Land Agent, Carnegie Natural Gas Company, Pittsburgh, Pa.

E. D. Batdorf, Cashier, The Dayton Gas Company, Dayton, Ohio.

W. C. Baxter, Superintendent, Wichita Pipe Line Company, Bartlesville, Okla.

L. B. Benson, Asst. Supt. Distribution, Empire Gas & Pipe Line Company, Bartlesville, Okla.

J. A. Blair, Traveling Salesman, Waterbury Company, New York, N. Y.

George W. Bovaird, Bovaird & Company, Bradford, Pa.

G. E. Brock, Asst. Supt., Gas Pipe Lines, Empire Gas & Pipe Line Company, Bartlesville, Okla.

A. L. Brown, Chemist, Preston Oil Company, Mansfield, Ohio.

L. G. Bub, Chief Teller, The East Ohio Gas Company, Cleveland, Ohio.

Frank L. Chase, Manager Gas Dept., Lone Star Gas Company, Fort Worth, Texas.

H. V. Couch, Purchasing Agent, United Natural Gas Company, Oil City, Pa.

Wm. G. Cummings, Proprietor, Wm. G. Cummings, Pittsburgh, Pa.

Charles DeWeese, Asst. Supt. Gas Distribution & Const., Louisville Gas & Electric Company, Louisville, Kentucky.

W. J. Doeble, Agent, Ohio Fuel Supply Co., Miamisburg, Ohio.

D. M. Donehue, Producer, Titusville, Pa.

George M. Evans, Contractor, P. N. G. & Phila. Co., New Kensington, Pa.

Todd Evans, Treasurer and Manager, Barnsdall Printing Co., Bradford, Pa.

H. A. Fisher, Proprietor, H. A. Fisher Company, Pittsburgh, Pa.

James P. Fisher, Chief Technologist, Wichita Natural Gas Company, Bartlesville, Okla.

A. J. Fitzgibbon, Salesman, A. M. Byers Company, Pittsburgh, Pa.

F. D. Freeland, Well Gauger, Peoples Natural Gas Company, Brave, Greene County, Pa.

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S. M. Gill, Assistant Credit Clerk, The East Ohio Gas Company, Cleveland, Ohio.

R. L. Heaton, Asst. Chief Geologist, Medina Gas & Fuel Company, Wooster, Ohio.

James Henderson, District Foreman, People's Natural Gas Company, Imperial, Pa.

Jesse Whalen Hines, Chief Dispatcher (Gas), Empire Gas & Pipe Line Company, Bartlesville, Okla.

William Horne, General Manager & Treasurer, Pure Oil & Gas Company, Marietta, Ohio.

H. R. Hyatt, Chief Engineer, Logan Natural Gas & Fuel Company, Pavonia, Ohio.

William T. Kent, Director, Tiona Gasoline Company, Brave, Pa.

Clark Knox, Salesman, Estate Stove Company, Crafton, Pa.

F. D. Krum, Agent, Pennsylvania Gas Company, Erie, Pa.

W. H. Lane, Civil Engineer, Logan Natural Gas & Fuel Company, Columbus, Ohio.

Harry M. Leathers, Gas Meter Engineer, Cutler-Hammer Manufacturing Company, Pittsburgh, Pa.

Fred M. Lege, Jr., 1st Vice President & General Manager, Lone Star Gas Company, Fort Worth, Texas.

G. W. McCullough, Land Agent, Mfg. Light & Heat Company, Pittsburg, Pa.

Donald W. Mackie, Manager, Bradford Supply Company, West Warren, Pa.

W. K. Mason, Division Superintendent, Carnegie Gas Company, Moundsville, W. Va.

R. A. McKinney, General Agent, The Manhattan Manufacturing Company, Pittsburgh, Pa.

John A. Miller, Chief Engineer, The Preston Oil Company, Pavonia, Ohio.

P. J. Morrissey, General Manager, Johnstown Fuel Supply Company, Johnstown, Pa.

S. E. Murphy, Mgr., Empire Gasoline Co., Bartlesville, Okla.

Franklin C. Murray, Representative, The B. F. Goodrich Rubber Company, Akron, Ohio.

C. O. Nordensen, Mgr., Huessener Engineering Company, Pittsburgh, Pa.

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J. F. Owens, General Manager, Muskogee Gas & Electric Company, Muskogee, Okla.
W. A. Pannabecker, Supt., Preston Oil Co., Lancaster, Ohio.
J. E. Parsons, General Auditor, The Ohio Fuel Supply Company, Pittsburgh, Pa.
D. V. Peden, Secretary to the President, The East Ohio Gas Company, Cleveland, Ohio.
Jesse Rearick, Chief Engineer, Logan Natural Gas & Fuel Company, Mt. Vernon, Ohio.
James D. Robertson, Representative, Pittsburgh Valve, Foundry & Construction Company, Pittsburgh, Pa.
Fred B. Seem, Supt. Tel. & Tel. Empire Gas & Pipe Line Company, Bartlesville, Okla.
Charles Seibert, Agent, Ohio Fuel Supply Company, New Lexington, Ohio.
G. E. Shoup, Purchasing Agent, Medina G. & F. Co., Wooster, Ohio.
W. H. Snyder, Oil & Gas Producer, W. H. Snyder, Beaver, Pa.
Charles M. Staigers, Lease Agent, L. G. Neely, Winchester, Ky.
Robert J. Wallacy, Supt. Contracts, Empire Companies, Bartlesville, Okla.
Olandus West, Pres. Vesper O. & G. Co., Clarksburg, W. Va.
Wm. H. Whiteley, with Wm. G. Cummings, Pittsburgh, Pa.

PRESIDENT GUFFEY: The next report will be the report of the Secretary and Treasurer.

Mr. T. C. Jones then submitted the following:

REPORT OF THE SECRETARY-TREASURER.

To the Natural Gas Association of America:

GENTLEMEN: I have the honor to present the Annual Report of the Secretary-Treasurer, for the year ending May 1, 1918.

MEMBERSHIP REPORT.

Honorary Members —
As per Membership Rolls, May 15, 1917.....

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Active Members—			
As per Membership Rolls, May 1, 1917		1,168	
Elected May 15, 1917		262	
		1,430	
Released from Membership May 15, 1917	142		
Died during the year	11	153	
Total			1,277
Total Membership this date			1,285

FINANCIAL REPORT.

RECEIPTS.

Balance on hand, May 1, 1917	$5,084 08
Dues	4,480 00
Initiation Fees	1,310 00
Books of Proceedings, Sold	30 00
Refund of, Whitehead & Hoage Co	30 18
Total	$10,934 26

EXPENDITURES.

Printing and Stationery	$2,347 59
Stenographic Report, Twelfth Annual Meeting	215 20
Clerical Assistance	53 45
Salary, Secretary-Treasurer	1,000 00
Wrinkle Department, Prizes	100 00
Badges and Buffalo Convention Expenses	441 06
Postage, Express and General Expenses	522 19
Balance on hand, Delaware Savings Bank	6,254 77
Total	$10,934 26

Mr. T. C. Jones then submitted the following:

REPORT OF SPECIAL FUND.

May 1, 1917, Balance	$6,282 06
Receipts from 1918 Dues	18,402 62
	$24,684 68
Expenditures	$12,750 24
May 1, 1918, Balance	$11,934 44

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PRESIDENT GUFFEY: Gentlemen, you have heard the reports of the Secretary and Treasurer. What is the wish of the Association?

MR. J. C. MCDOWELL: Mr. President, I move that the reports as read by Secretary Jones be accepted and placed on file.

MR. FRANK R. HUTCHINSON: I second the motion.

And thereupon the above motion having been duly seconded and carried, said reports were accepted, ordered placed on file and spread upon the minutes.

PRESIDENT GUFFEY: The next report is the report of the Finance Committee of which Mr. K. C. Krick is Chairman. I will call on Mr. Krick for his report.

Mr. K. C. Krick then submitted the following:

REPORT OF FINANCE COMMITTEE.

PITTSBURGH, PA., May 22nd, 1918.

To the Natural Gas Association of America:

GENTLEMEN: Your committee has checked the books of your Treasurer and find that as of May 1st, 1917, the General Account shows on hand at that time $5,084.08; receipts during year May 1st, 1917, to May 1st, 1918, from dues, initiations, fees, sale of books, etc., $5,850.18, total on hand and received, $10,934.26. Expenditures during same period $4,679.49, leaving a balance in the General Fund of $6,254.77 to the credit of T. C. Jones, Treasurer, in The Delaware Savings Bank, as per pass book balance of May 1st, 1918, submitted. Checks and receipted bills and expenditures were examined and found to agree with the above.

The "Special" or Pittsburgh Office Fund books showed a balance on hand May 1st, 1917, of $6,282.06, receipts May 1st, 1917, to May 1st, 1918, from company contributions, $18,402.62 or a total on hand and contributed of $24,684.68. Expenditures during same period $12,750.24, leaving balance on hand May 1st, 1918, $11,934.44 which agrees with the amount to the credit of T. C. Jones, Treasurer, "Special Account", in The Delaware Savings Bank, as per balanced pass book submitted.

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The Indemnity Bond of the Treasurer in the amount of $10,000 expiring June 14, 1918, was submitted.

Your committee recommend the suggestion of May 15, 1917, by the Auditing Committee at that time, regarding the advisability of a change in the system of accounting which would permit of a more complete audit.. We advise that this suggestion be followed out and such system inaugurated at once.

Your Committee would also recommend that the books and papers be in the hands of the Finance, or Auditing Committee, at least ten days before the Annual Meeting, so that the proper audit could be made.

Respectfully submitted,

K. C. KRICK,
J. H. MAXON,
A. A. ARMSTRONG.

On motion duly made and seconded, the above report was accepted, ordered placed on file and spread upon the minutes of the proceedings.

PRESIDENT GUFFEY: Gentlemen, it gives me pleasure to now call upon Mr. Karl Emmerling, Engineer of the East Ohio Gas Company, Cleveland, Ohio, who will present the first paper at our morning session upon the subject "Auxiliary or Dual Installations for Domestic and Industrial Consumers."

Mr. Karl Emmerling then read the following paper:

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AUXILIARY OR DUAL INSTALLATIONS FOR DOMESTIC AND INDUSTRIAL CONSUMERS.

By Karl Emmerling.

The price and shortage of coal during the winter of 1917-1918 caused an unprecedented demand for natural gas for heating purposes. This demand was such that most companies producing and distributing natural gas found it impossible to supply an adequate quantity to care for all domestic heating requirements, although every company did its utmost. According to all competent authorities neither the coal nor gas situations will be improved any this coming winter.

The situation from both the gas company's and the consumer's point of view is very serious, and steps should be taken to remedy it. Another co-related feature of importance is this — That the normal domestic peak load which now perplexes many natural gas companies in winter, and sooner or later will prove a thorn in the sides of all, is directly responsible for the lowering of domestic pressures to a point which has led to the public dissatisfaction, now very outspoken in various communities, and the demands which are being made for the establishing of impossible pressure standards. It has been suggested in some quarters that the curtailment of the present volume of domestic consumption might be effected, and that the substitution of a more continuous, well-defined volume of industrial consumption can be effected. But against this we have the unanimous pronouncements of the consuming public that preferential service be given to domestic consumers, and in this, generally speaking, the gas companies have not only concurred, but made their industrial contracts subservient to domestic consumption. Since this seems to be a settled policy, it would appear that the only logical thing for natural gas companies to do is to set about to alleviate the burdensomeness of domestic peak load requirements

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in extreme winter weather, and surely no one element will so quickly relieve the excessive drain upon their supply during such periods than to have a substantial percentage of their largest domestic users of gas ready to discontinue its use immediately, whenever necessary.

Some companies are more fortunate than others in their source of gas supply and the quality of their service is not lowered to any great degree in the cold weather, whereas other companies have from one to thirty days of low pressure trouble, and have as a result, much trouble in keeping their consumers satisfied. This is largely the result of lack of knowledge on the part of consumers, of the general conditions surrounding the production of gas. Whether this is because of inactivity on the part of the gas companies in placing the matter before the consumers, or the inability heretofore to interest the consumers in facts of this kind, is an open question, but the fact remains that most consumers of natural gas believe that these shortage conditions could be relieved by the turning on of more wells, the drilling of additional wells, or the tapping of additional reservoirs, not realizing that the gas companies have for several years been at their wit's end to increase the production with very little success.

It must be apparent to every thoughtful natural gas man that the greatly increased demand for their product created by reason of the coal shortage during the past winter, coupled with the constant and natural growth of the cities and towns, has brought about not only a temporary shortage in severe winter weather, but either has or will bring about a permanent shortage during succeeding winters unless an effective means of relieving the domestic peak load requirements during the coldest weather is found and adopted.

Gas Companies generally find that the aggregate number of consumers is increasing in direct proportion to the growth of the municipalities which they serve, while they are either experiencing trouble in obtaining the present supply of gas, or finding that even this is impossible, which brings them face to face with the fact that if anything like the present earnings are to be maintained, it is essential that they in some way maintain

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at least the present proportion of profitable consumers; everyone, generally speaking, agreeing that as soon as a consumer fails to use gas for heating, at least a great portion of the heating year, he becomes an unprofitable consumer for the reason that the overhead and cost of gas is in excess of the amount derived for gas sold, at present rates, for ordinary cooking and lighting purposes. So that it is essential that the gas companies take some immediate steps to keep on their lines the heating consumption during the periods when they are able to supply the same. Further than this, there is the investment to take care of the consumer. There has already been expended a certain amount of money which might be classed under the head "Cost of Attaching Business". This investment will have been in vain (in so far as the future is concerned) unless some steps are taken to hold the heating business at least seventy to eighty per cent of the possible two hundred heating days in climates like that of Cleveland and Pittsburgh, and the gas companies are able to supply a sufficient amount of gas to their consumers from eighty-five to ninety-five per cent of that time.

There is no question but what consumers who have used natural gas for heating purposes for any length of time certainly prefer it to any other kind of fuel and for this reason it seems that, if properly advised and the type of appliance suggested which will permit of the use of a substitute fuel during the periods of shortage, as for instance coal or oil, without causing any great inconvenience in changing from one to the other, the larger portion of the heating business can be retained for the natural gas companies. The prime object of this paper is to suggest methods and means by which this most essential result may be accomplished. Few consumers, in the face of recurring shortages, will continue with favor the use of gas burning appliances in coal heating furnaces or boilers. The installation of gas burners in such furnaces or boilers, once so extensively advocated and adopted by natural gas companies and their consumers alike, especially during the earlier years of bountiful supply, are no longer adequate to meet the requirements of the changed and changing conditions, due to the cause above men-

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tioned, and indicated by the periods of shortage during the past winter.

There are two general methods of centralized house heating, that is with warm air furnaces and with boilers — either steam or hot water. Of the two, the former method is by far the most common and will be discussed in greater detail.

There are two general types of warm air furnaces used for heating with natural gas — coal furnaces with gas burners, and straight gas furnaces — and neither used alone will meet the present situation.

If good burners are used in a coal furnace a thermal efficiency of from thirty to fifty percent can be obtained. When a man removes them during the first cold snap they usually stay out of the furnace until the cold weather is over for the year. Then perhaps they are again installed, consequently the gas company loses most of that man's heating business; as the possibility (which often resolves itself suddenly into a necessity) of personally enduring the dirt and discomfort of removing, and later on replacing gas burning appliances in such furnaces or boilers, or hiring a gas fitter to do so, is not contemplated with any degree of satisfaction. It is an irksome duty and an expense which will not be relished or endured very long. It must and will result ultimately in the adoption of coal for the entire winter season unless some adequate means as is herein suggested are generally adopted.

If burners are made that are easy to remove, or so they do not have to be removed, as for instance the common ring burners as used in many so-called combination furnaces, the gas bills are very high and the consumer dissatisfied.

On the other hand, a coal furnace with a straight gas furnace as an auxiliary, or viceversa, is known to work out satisfactorily. By providing the consumer with a two-fuel system, such as described above, he will have a dependable heating system which will be satisfactory in all weather conditions. Furthermore, the consumer thus equipped will continue to use gas during Fall and Spring and likewise during the Winter, except during these periods of extreme weather where the substitution

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of coal is distinctly desirable. A consumer will provide himself with sufficient solid fuel to carry him over the time when gas is lacking, and when the shortage is at an end, will automatically go back to gas on account of the increased convenience. Furthermore, a man thus equipped will have a very efficient heating arrangement. He has a gas furnace which has an efficiency of from sixty to eighty-five percent and also a means of burning coal efficiently and his fuel bills will be consistent with the size of house heated and the weather conditions.

Figure 1.

There are several types of auxiliary gas and coal furnaces, of which illustrations 1, 2, 3, are typical.

In case the coal furnace, because of being worn out, has to be entirely removed, or in a new home, a two-fuel furnace containing two heating units in one, such as shown in illustration No. 4, answers the same purpose as the two units, that is, the

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Figure 2.

Figure 3.

Figure 4.

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coal furnace and the auxiliary gas unit. The gas unit, it is readily understood, should have the long fire travel needed for gaseous fuel in order that the proper efficiency can be had, while the coal unit should have a sufficiently large fire pot and a much shorter fire travel.

It will take much advertising, soliciting, and perhaps require the formation of a new department by the gas companies to induce people to make the extra outlay necessary to have a heating arrangement that will keep their houses warm, and still make it possible for the gas companies to sell their maximum amount of gas.

In order to see to it that the consumer gets an adequate and efficient appliance, it seems almost certain that the natural gas companies will have to do what the artificial companies have done for years, that is, they will have to handle the appliances which they want the consumer to use, and make offers which will be attractive enough to the consumer to make him want to spend the extra money necessary to give him a two-fuel heating system.

If the desired results are to be had in connection with cutting off the peak load by the introduction of auxiliary appliances, it will not be possible to leave the matter in the hands of the dealers. The gas companies themselves will have to take up the burden in order to get prompt results. Where a dealer might sell one appliance at a price that will give him a fair return upon his investment, the gas company, by eliminating this feature and instituting a partial payment system, must sell a great many times this number. It can only be done by eliminating all profit and instigating a well defined and generous advertising campaign, together with personal solicitation on the part of the gas company's representatives, properly trained and educated, so that they may give the consumer all the facts and figures in connection with the installation of these appliances; and behind all this, the company's recommendation as to the desirability from the consumer's standpoint, of the appliances.

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There will, of course, be objections raised by a great many as to the desirability of companies handling appliances.

First — The fear of prejudicing the dealers who handle furnaces. The dealers seldom, if ever, advertise or solicit the sale of furnaces and as the auxiliary furnace is not well known to the public, it would mean an entirely new field for the dealers, necessitating much advertising, which in most cases they have neither the money nor the inclination to do.

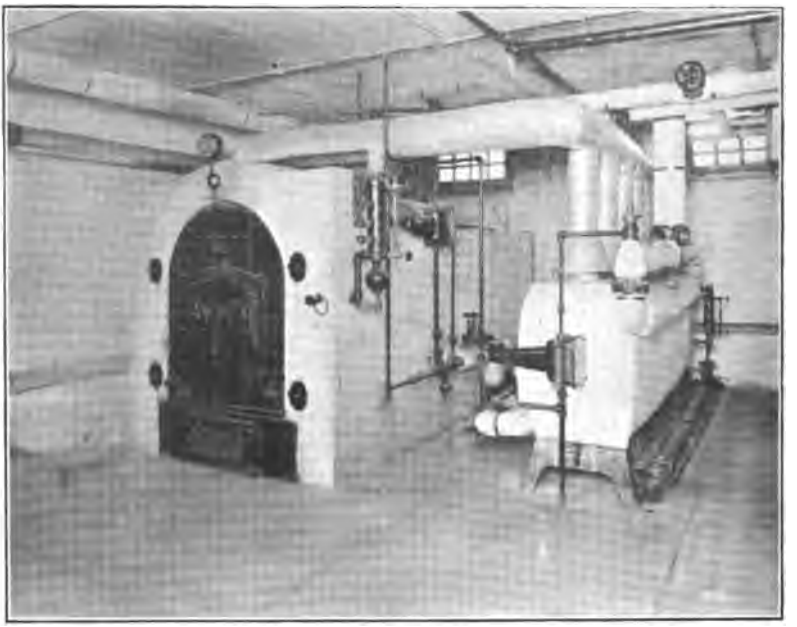

Figure 5.

Second — Fear of increasing the consumption of gas rather than checking it. It is not for the purpose of increasing, but rather retaining and decreasing each individual bill that the gas companies should engage in the sale of auxiliary furnaces. If the majority of consumers had a two-fuel heating system they would all adjust themselves to using natural gas when available and some other solid fuel when the gas supply is insufficient, the

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actual number of such furnaces would have no effect on the supply excepting that all the gas that could be supplied at an adequate pressure would be used.

Third — Fear of damage claims. Damage claims are an unavoidable evil which the large artificial gas companies have been able to contend with — why not the natural gas companies?

Fourth — The investment required. Undoubtedly a considerable investment would be required, but in the end the cost would be repaid in the increased good will, and constant peak sales. The consumer will most certainly revert to coal or some other fuel permanently if the shortages experienced last winter keep up and he is not shown some way of providing himself with a heating system where gas and some other fuel can both be used.

Auxiliary boilers for steam and hot water heating systems should be given the same attention that the warm air furnaces get. Here as in the use of warm air furnaces, a gas boiler can be made auxiliary to a coal boiler, or viceversa, and when the supply is sufficient the gas boiler will be in use on account of the greater convenience. Here a readily removable kerosene burner might be of some value, as the average consumer that has hot water or steam heat in his home is generally equipped to provide for storage of kerosene or fuel oil. Illustrations 5 and 6 show typical auxiliary boiler installations and illustration 7 shows a kerosene burner adaptable for this type of work.

One thing is absolutely necessary, that is, that the consumer gets the best appliance for his money. Before a campaign to persuade him to install auxiliary furnaces is started, the gas company should assure itself that the appliances they are advertising are the safest, most efficient and strongest that can be had for the price. The various auxiliary furnaces on the market that appear to be of value should be examined and in some manner, graded as to efficiency, price, etc., and the one showing the greatest merit should be the one recommended and sold.

In this connection, we must not, of course, overlook the industrial consumer, as during the summer months he is the

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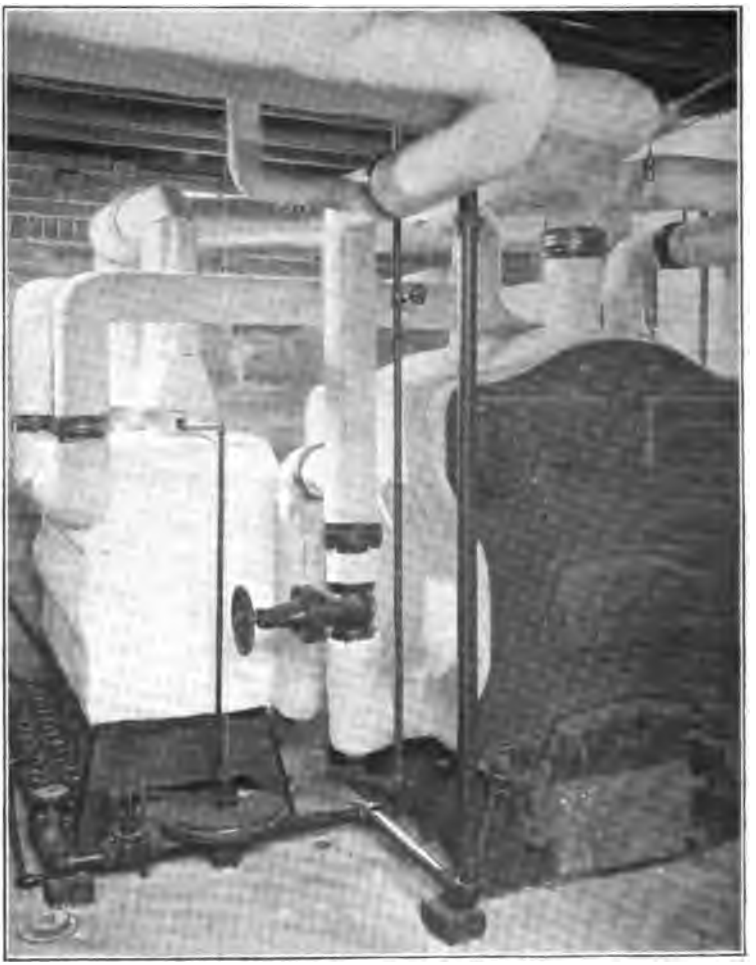

Figure 6.

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all-important one, in so far as the natural gas companies are concerned. Several years ago, a number of natural gas companies had sufficient gas to supply both their domestic and industrial consumers. Most companies, however, were obliged to shut off the gas supply for industrial use last winter, and it is

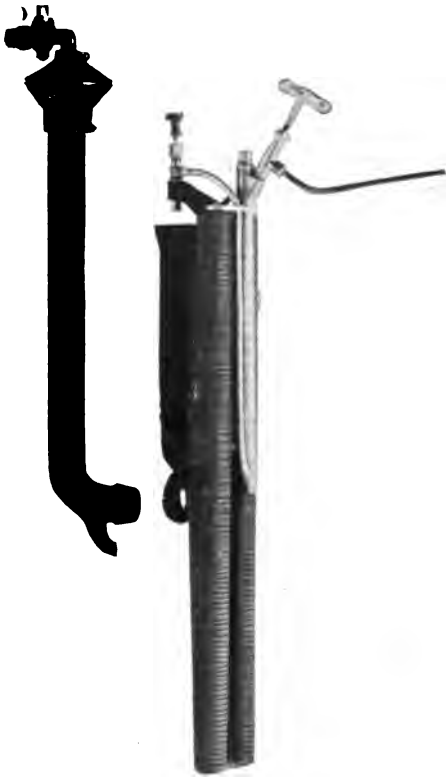

Figure 7.

only a question of time when all natural gas companies will be obliged to do the same.

In order to supply the consumer with gas under the changed conditions, industrial consumers must be equipped, as should be the domestic consumers, to substitute oil or coal for gas by

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means of dual equipment without retarding their production, so that they can change from gas to oil on their forging furnaces, core ovens or melting furnaces, by merely shutting off the gas valve and turning on the oil valve. Figure No. 8 shows a combination gas and oil burner for use in industrial appliances. The appliance should be designed for natural gas because this fuel can be obtained the greater part of the year. Figures 9 and 10 show appliances equipped with these burners.

Manufacturers using gas engines should have their plants equipped with carburetors so that they can use liquid fuel or with gas producers, so that they can use producer gas during

Figure 8.

the extremely cold days in winter. Just which equipment they choose depends largely on local conditions and on the capacity of their plant. If the gas engine plant is large and the shut off periods are of long duration, producer gas plants should be installed. If the plant is small and the shut off periods of short duration, the carburetor equipment should be installed. Figure 11 shows a gas engine equipped to operate on natural gas, producer gas or gasoline. No matter which fuel the industrial consumer uses as a substitute for natural gas, he will find in summing up his year's fuel cost for gas engines, that he has saved money by using natural gas when available over what the cost would have been, had he used another fuel entirely.

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Gas companies should exert every effort to retain the industrial business during the summer months when the domestic consumption is light. This can be done only by co-operating with industrial consumers to the fullest extent, by advising them in the spring of the year, just what they may expect and what they must prepare for during the coming winter, by telling them how to equip their plants to the best advantage, and if necessary, where to obtain their equipment.

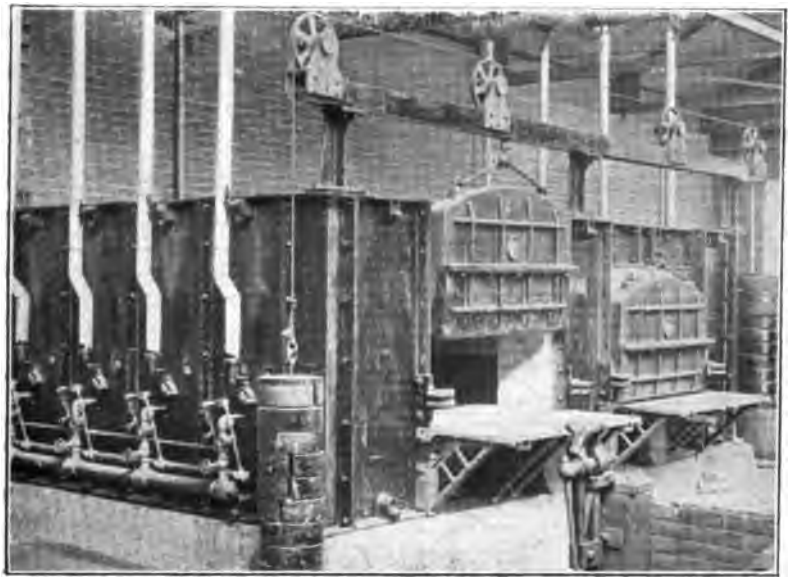

Figure 9.

In advising the Industrial consumer, just as much care should be taken as in the case of the domestic consumer, that he be equipped with the best possible dual equipment. However, as a great many of the larger consumers have men that are well versed in the use of various fuels for their individual problems, the matter of assisting them will be a simple matter.

Summing up, the consumer must be told very clearly and frankly how the situation lies, what must be done by him to

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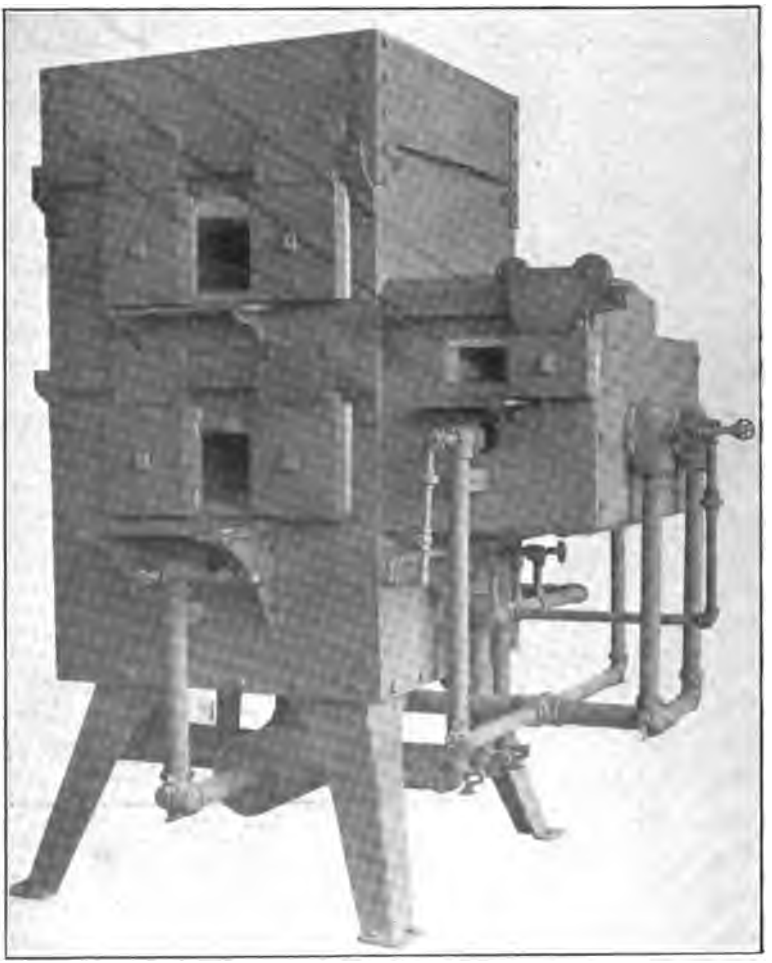

Figure 10.

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make it possible to use natural gas the greatest portion of the time, and still have a convenient and economical way of heating when natural gas is not available, and how he is to go about getting the appliances that he needs. If that is done the gas companies will find that they will be able to hold most of their heating business and also improve their operating conditions.

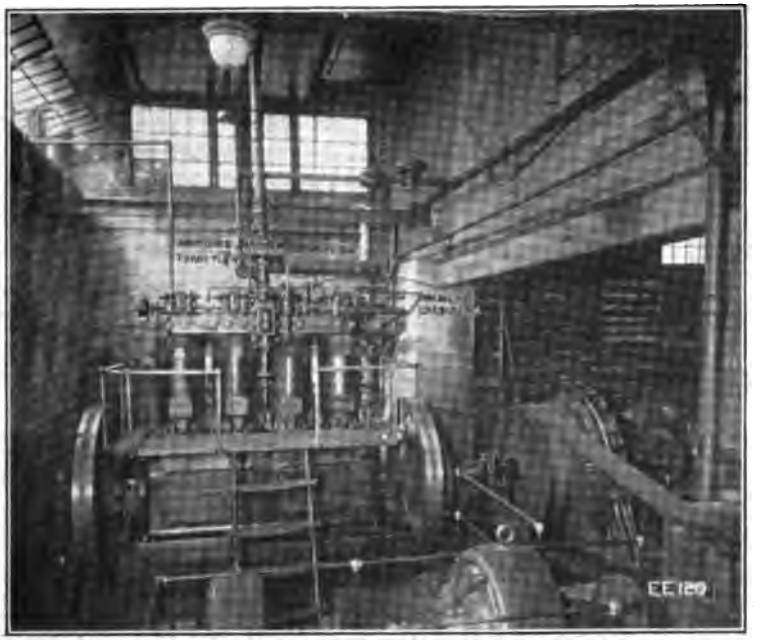

Figure 11.

DISCUSSION.

PRESIDENT GUFFEY: I am sure every member present joins me in thanking Mr. Emmerling for his very interesting and instructing paper. I think the best way to show our appreciation of his paper is for as many as possible to join in the discussion of the subject. The meeting is now open for this discussion and we would be pleased to hear from any member present.

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MR. DONALD MCDONALD: Mr. President, I have listened with a great deal of interest to that paper. I did not read it before I came to the meeting, but that is my fault.

I agree with every word in it but it does not go far enough. If our customers are equipped to heat with both gas and coal, they will not heat with coal so long as they can get the gas. What is the result? The result is that three hundred people will not have the fuel with which to cook their meals in order that one family gets an abundance of gas to heat a great mansion with. Fifty feet a day will do the cooking of an ordinary family of moderate means. Fifteen thousand feet a day is no more than the mansion uses for its heating. In other words we not only need the installation of dual appliances but we need the aid of the public authorities in saying that when there is not enough gas for everybody, the necessity of the many shall prevail over the luxuries of the few. (Applause).

Gas Companies should not look at this question entirely from the standpoint of revenue. They have a duty which they owe to the public which, unless they perform, their names become a by-word in the communities in which they exist and the unpopularity gained by them during the cold days of winter comes back to them in many ways after the winter is past. I do not fear at all that we will not get all the heating business we want when the weather is cold. Even when gas is more expensive than coal people who have once heated with it will not go back to coal as long as they can get it. My experience is that when many consumers have gone cold because they could not get gas for a few days on account of low pressure, good pressure will put those people back again on gas regardless of previous inconveniences, and the result of it is that 1 per cent of your consumers will use 25 per cent of your gas; 2 per cent will use nearly 50 per cent of your gas and 98 per cent will go without gas to cook their meals with.

It is a small matter to heat a house with coal. It merely requires the installation of proper appliances and the energy and at present the self-denial and public spirit necessary to build a coal fire. But when it comes to cooking, you could not get every

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consumer to have both a coal stove and gas stove. It is nonsense. When it comes to water heating appliances they are not made to burn coal so that the householder of moderate means is robbed of the little quantity of gas he needs for heating water and for the necessities of life. So I maintain that our duty is to give the great mass of our customers gas enough for cooking; gas enough for heating water and then to get such assistance as is necessary from the public authorities in order to compel those who need immense quantities of gas to heat manison, to heat those mansions with coal. Coal can be stored in the summer. Gas cannot and the ordinary selfishness of men will cause them to have coal on hand with which to heat when they cannot get gas but that same selfishness will cause them to burn gas even though they have got the coal, until they hold the pressure down to half an ounce and hundreds of their neighbors are unable to cook for want of gas. That is the real problem before us gentlemen and we must face it from that standpoint, — from the standpoint of our public duty and part of that public duty is, when there is not enough for everybody, to let necessity prevail over luxury. I thank you. (Applause).

MR. J. C. MCDOWELL: Mr. President, I think we will have great difficulty in restricting the use of gas. That is, telling a man what he shall use it for. There is a decision of the Supreme Court of Pennsylvania which says explicitly that after the gas has passed the meter a man may use it for whatever purpose he chooses to use it for and until that is reversed we would find difficulty in getting the proper authorities to restrict a man in his use of gas. I am heartily in favor of auxiliary heating appliances. In many parts of the United States where Fuel Oil is available at reasonable prices I think Fuel Oil might be used advantageously. There is at present in California a burner that has over four thousand installations. It is a burner with a rotary spraying apparatus and the little power that is required is supplied by a small electric motor. It has also been introduced into some of the New England States. It works most satisfactorily. I think such an apparatus as that might be combined with the Natural Gas as an auxiliary and the results I feel

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quite confident would be successful in conserving Natural Gas at a time when it is most needed.

MR. FRANK R. HUTCHINSON: Mr. President and Fellow Members of the Natural Gas Association of America:

Mr. McDonald made the statement that 50 feet of gas would be required for cooking by an average family per day while 15,000 feet would be required for heating a home. I presume Mr. McDonald refers to a mansion.

MR. MCDONALD: I did. I said a mansion.

MR. HUTCHINSON: It must be "some mansion" for I would think 1,000 cubic feet a day is nearer the fair average for the average home. I have prepared a few suggestions by way of discussion of the most excellent paper submitted by Mr. Emmerling and with your permission I will now read them:

"We are all agreed that the interruptions in gas service last winter were unavoidable. Many of the Companies here represented attempted through circular letters, printed statements and in newspaper columns, to, in a general way, warn their consumers, before shortages occurred, to provide themselves with double equipment. Some consumers read and heeded the warnings, but the vast majority did not. Doubtless, because of the very general way in which these warnings were issued, they were not understood. I am free to say to you gentlemen, it is my opinion they were not specific enough. The efforts made, no doubt, were helpful, but, you did not go far enough. Experience has proven it is impossible to convey your exact meaning in an understandable way without your representatives coming in personal contact with the consumer and having a knowledge of just how he is equipped so as to intelligently advise him a way to care for his requirements. Most consumers view these interruptions as inexcusable. The attitude of the masses toward gas companies, generally speaking, is one of distrust. Shortages aggravate this condition.

Unless drastic methods are taken, doubtless gas companies will face unjust rulings and legislation. Some of you are already facing such a situation.

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Do you realize men, the very foundation of the business is shaking?

The remedy, since perhaps under existing conditions, a cure cannot be entirely effected, is to take the public into your confidence. If you want to make friends of your consumers, *do something for them.* Friendliness is good will. Don't wait to be asked what to do, anticipate your domestic and industrial consumers troubles, make a survey of each and every consumers needs, advise them properly a way out of their difficulty, even before it again occurs, and the reward will be greater than you can imagine.

This is not a time for mere talk — action must be given. To secure the results you want to accomplish, you must establish a department to solicit and sell Auxiliary Cooking, Heating and Industrial Appliances. Efforts have been attempted by some companies to do this by cooperation with dealers. Some little success has been met in this way. But, so little was accomplished as to make the results almost negligible. Experience proves the thing must be done by the Gas Company. Don't sit back, possibly because of precedent, and wait for some other fellow to help you out of your difficulty. Remember, this is your trouble, not his. Get busy and help yourself, act and act quickly, for unless you do, the situation may, and probably will, become more serious than you now realize.

In my judgment, the merchandizing of appliances is now an absolute necessity and vital to the natural gas industry. Close contact with your consumers and intimate acquaintance of their needs, with proper advice as to the right and wrong way to employ gas as fuel, will prove an investment well made.

Many executives — and these are the gentlemen I am particularly addressing, — for they fix upon the policy of the companies they represent, may now, as they have in the past, look with disfavor upon selling auxiliary appliances. Get this out of your minds, forget precedent, think quickly over the subject matter of this paper, so ably presented by Mr. Emmerling and the discussions it is bringing out, then busily prepare to doubly

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equip your consumers and forestall this loud public wail and criticism.

Have personal calls made at each home and factory, advise what to do and how to do it. Even though consumer, for various reasons, may then conclude not to adopt your suggestions, — when interruptions in supply occur, instead of condemning the gas company, he will probably soliloquize to himself — *"wasn't I a dunce not to* put in that auxiliary appliance as advised by the gas company". Won't he blame himself rather than the gas company?

Think this over, you'll realize that will be their attitude. Further, it is a patriotic duty for each and every gas company to prevent, so far as possible, the waste of gas. Every cubic foot should be made useful in the most efficient way possible. Each cubic foot of natural gas used, helps save that much coal and its attending transport and hauling. Munitions and war supplies must be moved, regardless of the discomfort this may occasion through failure to transport coal.

Remember men, it is not for the purpose of increasing, but rather decreasing consumption, *safe, durable* and *efficient* auxiliary gas burning appliances should be recommended, sold and installed by gas companies. The maximum consumption, for example, of an average set of burners in a coal warm air furnace is about 160 cubic feet per hour, through a gas designed auxiliary warm air furnace only about 100 cubic feet per hour.

Think what such a saving means. Revolve in your own mind, if all your consumers were properly equipped for heating, how much this saving would aggregate in cubic feet. How many pounds or tons of coal would it save?

To sum up, I have been most frank in my discussion, but earnestly so because of my knowledge of conditions, both as a gas man and as an appliance man and I can truthfully and honestly say I am absolutely sincere when I add that, for the life of me, I can't understand why many of the gas companies haven't seen the 'light' before and taken up this matter, with spirit and zest, several years ago without waiting for the situation to become so acute as it has this past winter." (Applause).

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PRESIDENT GUFFEY: Any further discussion? Mr. Krick have you anything to say on this subject?

MR. K. C. KRICK: No, I believe not.

PRESIDENT GUFFEY: Mr. R. W. Gallagher, of East Ohio, have you anything to say?

MR. R. W. GALLAGHER: I heartily coincide with what has been suggested by Mr. Emmerling and as I feel he has covered the subject very thoroughly there is nothing to add to it on my part.

PRESIDENT GUFFEY: Is there any other member who has any remarks to offer by way of discussion?

MR. DONALD MCDONALD: Mr. President, nobody else seems to want to talk. This is a matter that I think is exceedingly important. One of the speakers mentioned the legal difficulty involved, and said that there were decisions of courts to the effect that after the gas once passes the meter it is the property of the consumer and he can use it for what he pleases. The same is true of wheat. The same is true of sugar and yet there are decisions to the effect that when there is not enough to go around, everybody shall have a fair share before anybody gets an excess. Now, should that not apply to a necessity of life like gas just as it does to sugar and to wheat? We can live without sugar and wheat. People cannot live without cooking. I do not advocate that we should ask the Courts or the Public Service Commission to say that people shall not heat with gas. I do advocate that Public Service Commissions in fairness to the public should say that whenever there is not enough gas for everybody to take all he is willing to pay for then that everybody shall get enough for his necessities before anybody is allowed to take on an excessive amount for his luxury. I do not fear the falling off of the demand. There is no danger of that. We all know that it is the best fuel obtainable. That it is the least troublesome and at present it is cheaper than coal. There is no possibility of the gas producers being able to supply enough to take the place of all the coal and yet at present prices if people could get the gas they would burn it in preference to coal.

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Now we are trying to perform a public duty which is to keep in our mains sufficient pressure to supply the necessary domestic uses and to meet the requirements of our customers. Now we have come to a time when we cannot furnish that amount of gas. Almost every city in the United States found it so last year. Now when that time comes should we sit by supinely and say that one man may have 15,000 feet a day for heating a mansion although in order to give him that 15,000 feet a day three hundred people — who are our customers also — cannot get 50 feet a day with which to cook? Is it reasonable? Is it fair?

We must remember that we are dealing with the public who do not understand this subject from the technical standpoint. We do know or are supposed to know it from the technical standpoint. Should we not enlighten the public and enlighten the authorities who control this matter, on that subject? If we can give good service to most of our customers although it involves three or four per cent of them going back to coal for heating, we would not be the by-word in our communities that some of us are. As long as people are able to say that when they need the gas the most they cannot get it we will have to submit to the unpopular position in which it places us. They need it the worst when they need it for cooking. They can heat with coal but they cannot cook with coal. (Applause).

PRESIDENT GUFFEY: Mr. Norris have you anything to say on this subject?

MR. H. S. NORRIS: Mr. President and Members of the Association: I agree most heartily with what Mr. McDonald has had to say. Our condition in Buffalo has been very serious the past year. In fact when we got to a temperature of thirty this spring we were very short of gas. From an investigation which has been going on for the last six weeks or more we have come to the conclusion that the large householder who is using natural gas for heating purposes is stealing it away from the small domestic consumer who wishes to use it for cooking purposes. In many instances they have their cellars full of coal but under presnt conditions they do not want to use the

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coal for fear they cannot get a further supply of coal and hence they continue to use the gas regardless of the inconvenience they occasion to the small domestic consumer.

In my opinion if it is a question of law we should seek a remedy before the Public Service Commissioners looking toward a decision by them giving us authority to do certain things to help out the Gas Companies at a critical time when the larger majority of our consumers are in need of natural gas for such domestic uses as have been suggested. In Buffalo we cannot do anything else than deliver the gas to the meter as it has been held by the Courts that when it passes the meter it becomes the property of the consumer and he can do anything with it that he pleases. We haven't any special contracts like the contracts existing in Pittsburgh and Cleveland and numerous other places. We have to give them what they will take. We should make concerted effort to remedy this situation so that we may be able to meet the demands of the small domestic consumer. We should go before the Public Service Commission and say "Will you grant such and such authority so as to control this proposition?" If we cut off our industrial consumers we would not save 7 per cent. Out of a delivery of fifty-five million in the coldest weather if we cut out our furnace consumers we would save ten million feet a day. Yet ten million feet a day would help out wonderfully in such critical periods. The pull would not be so strong all at one time as to exhaust your supply. My opinion is that we should make a concerted effort to ascertain what the Public Service Commissions will be able to do to help you out. And further than that to increase the price of gas so as to shut off these large consumers in that way if no other. (Applause).

PRESIDENT GUFFEY: The subject is open for further discussion and we will be pleased to hear from any other member present by way of suggestion or by way of criticism.

MR. FRANK R. HUTCHINSON: Mr. President, it invariably happens where double equipment is installed for heating and the householder is provided with coal, when the gas becomes so low that he is not able to keep his home comfortably heated

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with gas he will resort to coal. I do not think there is any question about that. Take it home to yourself. If you had two furnaces or two boilers in your basement, one for gas and one for coal, and you could burn either or both fuels and you are short of gas and your home was not warm of course you would burn coal. So it is a situation that is automatically handled by the exigencies which exist at the time, where double equipment in installed, and that is what I think Mr. Emmerling was intending to bring out in his paper in recommending this double equipment.

PRESIDENT GUFFEY: Does anyone else desire to discuss the subject? If not we will proceed to the next paper.

It gives me great pleasure to introduce to you as the next speaker Mr. Samuel S. Wyer of Columbus, Ohio, who read a paper entitled "Elimination of Discrimination in Natural Gas Rates by 'Readiness to Serve' Charges."

Mr. Samuel S. Wyer then read the following paper:

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ELIMINATION OF DISCRIMINATION IN NATURAL GAS RATES BY 'READINESS TO SERVE' CHARGES.

By Samuel S. Wyer.

Sec. 1 — *Definition of Readiness-to-Serve Charge.*

Readiness-to-serve is a form of minimum charge made to cover the costs incurred by the utility in holding itself in constant readiness to render service, without, however, delivering any units of service. The actual units of service (such as kilowatt hours of electric energy, cubic feet of gas, gallons of water, or number of messages) used are paid for by an additional rate schedule.

The readiness-to-serve charge has been made primarily in electric utilities; however, this practice is applicable to all public utility rate schedules. The term "demand charge" is used synonymously with "readiness-to-serve."

Sec. 2—*Readiness-to-Serve and Minimum Charge Distinguished.*

The term "minimum charge" as used in public utility rate parlance means merely the minimum monthly bill which will be rendered, which includes a certain definite number of units of public utility service. The consumer, however, pays the entire minimum bill, regardless of whether or not he has used the number of units of public utility service that go with the minimum bill charge.

A readiness-to-serve charge merely covers the cost of standing ready to render the service. It never includes any units of service. Where no minimum charge or readiness-to-serve charge is made the utility is compelled to incur a number of expenses to carry consumers who pay very little to the utility. When

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A part of the data given in Sections 1, 2, 3, 4, and 5, were taken from an article on Readiness to Serve Charges for Public Utility Services, by the author, in Case and Comment, page 1031, May, 1916.

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such carrying costs are not paid by the consumer for whom they are incurred, they must, therefore, be carried by other consumers and thus produce discrimination. In brief, while the minimum charge is an approach to non-discrimination, the readiness-to-serve charge is its realization.

SEC. 3 — *Meter Rental Distinguished from Readiness-to-Serve and Minimum Charge.*

The readiness-to-serve charge is made simply for service rendered. The minimum charge bill is a combination charge for service rendered and a certain number of units of service sold.

Meter rental is rental for equipment which the utility is under obligation to furnish the consumer, and the rental is added to the bill regardless of the monthly service consumption. It is wrong in principle and ought never to be considered. Failure to distinguish between readiness-to-serve, minimum charge, and meter rental has been the cause of much confusion and some unsound decisions from judicial bodies. A number of attempts have been made to regard the meter rental as synonymous with a readiness-to-serve charge; however, this is illogical because what would be embraced by the meter rental as far as consumer costs are concerned would be represented only by the first part of the readiness-to-serve charge as covered by the consumer charge in Section 11 herein. Such a substitution of terms would ignore entirely the demand charge feature of the readiness-to-serve charge and would still be discrimination.

SEC. 4 — *"Connected Load" Defined.*

The term "connected load" means the aggregate capacity of all the public utility service using devices on the consumer's premises. It represents the maximum demand that can be made for service when all the public utility service using appliances are in use at the same time.

SEC. 5 — *"Active Connected Load" defined.*

Practically every public utility consumer has more or less equipment that is seldom used. The term "active connected

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load" has become an arbitrary designation for that part of the consumer's total connected load that is generally, or may be generally, in use.

SEC. 6 — *Service Features Dominate Public Utility Business.*

The furnishing of a service rather than the delivery of a commodity or product is the dominating feature of public utility enterprises. Thus, when an electric utility takes crude coal and converts it into usable electric energy available for instant use at the consumer's appliances, or a water utility fetches and maintains water at the consumer's fixtures, or a manufactured gas utility converts crude, solid or liquid fuels into gas available for the consumer's instant use, or a natural gas utility prospects for, finds and reduces the fugitive wandering and uncontrolled natural gas to possession, and then converts this crude natural gas — made up of a mechanical mixture of permanent gases and condensible vapors — into a controlled and usable service delivered to the consumer's fixtures, usually many miles from the gas field, the service features pertaining to the method and manner of delivery, and standing ready to serve are of much more importance than the product or commodity.

With natural gas the "standards of public utility service" that may be reasonably asked for are controlled by the fact that natural gas is an exhaustible resource that is becoming scarcer every year, and it is the only public utility service that does not, and in fact cannot create the basic feature of the service that it renders to the public. There is no regeneration in the present fields, that are now being depleted; when the gas is once used it is gone forever. Every time a natural gas company sells 1,000 cubic feet of gas it is selling a non-replacable part of its property. That is, the natural gas company is alone in depending entirely on the caprice of nature for first the finding and secondly the continuity of the supply of its primary source of public utility service. This ought to make it self-evident that more latitude must be allowed in natural gas plant standards of service than are necessary in other public utilities.

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SEC. 7 — *Relation of Fixed Charges and Load Factor to Readiness-to-Serve.*

"If the total annual expenses of a utility are taken at 100 per cent, then the fixed charges are that part of the total 100 per cent of annual expenses that must be met in order to maintain the integrity of the property value, regardless of the quantity of service rendered. That is, these fixed charges accrue regardless of the volume of the utility's business and range from 49 per cent to 73 per cent, depending on the type of the utility.

If the total continuous full load of the serving capacity of the plant is taken at 100 per cent, then the load factor is that part of the total 100 per cent of service capacity that is actually sold. Seasonal and hourly load variations — with marked peaks — are conspicuous features of public utility plants. These result in low load factors and many potential service facilities cannot be utilized although the inevitable fixed charges are constantly accruing. Most utility plants must be so operated as to have not more than 30 per cent load factor, with, of course, a large range of individual variations for individual plants." * That is, the utility must be in constant readiness-to-serve, on account of the facts just mentioned, and only a relatively small part of its total serving possibilities can be actually utilized.

SEC. 8 — *Peak Loads Increase Cost of Service.*

"An increase of volume of business can decrease the cost of production only when the increment of increase is distributed so as to make possible the more efficient use of existing equipment. When the increment of increase is concentrated so as to require more equipment, as is the case in all peak loads, the cost of production per unit of service is increased. Therefore, the cost of peak load natural gas service is greater than the cost of normal service. A rate schedule, to be equitable to all consumers of natural gas, must make the consumers who need and create the peak load service, pay a price that will be commensurate with the extra cost of the service they are receiving.

* "Value-of-Service" as a Factor in Public Utility Rates With Special Reference to Natural Gas Rates, p. 14. By Samuel S. Wyer.

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"House heating furnace services not only produce marked peaks each day, but the consumption is limited to relatively a short period out of each year. For this reason house heating furnace service costs more than ordinary gas service:" †

SEC. 9 — *Distinction Between Luxury and Necessity in Natural Gas Service.*

"To the average family for cooking, hot water boiler heating, lighting and incidental house heating service, natural gas is a necessity, but when used in larger quantities, or for house heating furnace work, it becomes a luxury. Furthermore, the peak load characteristics of house heating furnace service makes this service cost more to the natural gas company. An equitable schedule of rates ought, therefore, to provide for a fixed net price per thousand cubic feet for a large enough monthly consumption to permit of the cooking, hot water boiler heating, lighting and incidental house heating service necessary in the average family. If this fixed consumption is exceeded, then the price per thousand cubic feet for such excess consumption ought to be increased so as to make the consumer pay for the higher priced service he is receiving." ‡

It is a trite observation that the luxuries of one day tend to become the necessities of the next. Most complaints for inadequate service, during the few peak load hours, — usually less than 1 per cent of the total 8,760 hours in the year‡ — are based on the fallacy that a service which is purely a privilege has become a prerogative. That is, natural gas consumers, as compared with other fuel users who have to use solid fuel or manufactured gas, are a privileged class enjoying a luxury that is seldom appreciated until it becomes difficult to obtain, and on account of the limitations fixed by nature they do not possess

† Engineering Report on Wholesale Cost and Worth of Natural Gas Service at the Gates of the Various Towns, and Valuation of all the property of the Kansas Natural Gas Company, December 27, 1912. By Samuel S. Wyer.

‡ Few people appreciate that even if the service averages below normal 5 hours per day for 17 days, that the total period of normal service is still more than 99 per cent.

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and cannot ask any inalienable rights of service, under conditions that are physically impossible to meet.

SEC. 10 — *Methods of Selling Utility Service.*

Public utility services are sold by the following three methods:

A. Flat Rate — This eliminates the measuring devices, but is inequitable, places a premium on waste and is desirable from most viewpoints.

B. Meter Rate — Here the charge is based on a certain price per unit of service. This would apparently be just, but it ignores the "readiness-to-serve" and "value-of-service" features, both of which must be considered in the application of an equitable rate schedule. This divides itself into the following:

   a. Straight Meter Rate — That is, uniform price per unit of service to all consumers for certain classes of service. This makes the cost exceed the value of the service in some instances, and the consumer will not use the service. This makes necessary the following sliding scale adjustment:

   b. Meter Rate with Quantity Discount — That is, the price will be decreased as the consumption or quantity used is increased. This sliding scale when used alone has some unjust features, in that it permits the large consumer to acquire service at a lower figure than the small consumer, making the distinction solely on the quantity purchased.

   c. Meter Rate with Quantity Penalty—This penalizes the large consumption, in accordance with the principles laid down in Section 9 herein. That is, the schedule has a fixed price for say the first 5,000 cubic feet per month, with an increasing price for all additional consumption per month.

   d. Minimum Charge — The preceding three methods do not make the consumer who may use very little service at times pay for the cost that he is creating,

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in having potential service possibilities which he is not using, which, of course, must then be collectively paid by all consumers. To overcome this a minimum charge, as defined in Section 2, was introduced.

C. Readiness-to-Serve Charge Plus Unit Charge for Service Actually Utilized — In this the consumer first pays the costs incurred in having his premises connected to the constant serving possibilities of the utility's plant, and this is paid whether any units of service are delivered or not. The units of service are then paid for in addition at so much per unit. If these costs are not thus allocated, the user of a large number of service units must pay a portion of the small user's consumer costs. Manifestly this is unjust. Such small consumers — which are not necessarily and in fact usually are not poor people — become social parasites that must have the cost of their service paid for by other consumers.

The readiness-to-serve charges are much like the membership dues in a club; the charge gives the house privileges, but all service used is paid for in addition. No club could exist without making its members pay for the cost of the service included in giving them an opportunity to enter the club house and use its services. In fact, a readiness-to-serve charge is simply a monthly due for membership in a community enterprise.

SEC. 11 — *Basis for Readiness-to-Serve Charge.*

Quite frequently the readiness-to-serve charge is divided into the following two parts:

A. Consumer or Customer Charge — This includes all of the expenses pertaining to the consumer's service connections, and may be analyzed as follows, where the various items relate to the service line and meter:
   a. Depreciation on service and meter.
   b. Return on value of service and meter.
   c. Repairs.

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d. Clerical work.
e. Meter reading cost.
f. General overhead expense.
If the services and meters represent say 10 per cent of the total property value, then 10 per cent of the general overhead expense ought to be prorated on this part of the business.

B. Demand Charge — Pertaining to each consumer's possible demands for service from the utility. That is, this considers the consumer's connected load and the total demands that he may make on the utility for service at any one time.

No hard and fast rule can be laid down. While the consumer or customer charge part is clearly defined, the demand charge part of the readiness-to-serve charge opens a wide field for difference of opinion. In this all conclusions must be tempered by business judgment and sometimes by expediency and policy. No conclusions or estimates can be made which will be universal in their application. The fundamental feature to always be borne in mind is that the primary function of the readiness-to-serve charge is to stabilize and equitably distribute the cost of carrying the various consumers, rather than to produce a gross revenue which might all come from a uniform output charge against all consumers.

SEC. 12 — *Limits of Readiness-to-Serve Charges.*

There is a mutuality of interests between the producing, transporting and distributing branches of the natural gas business. Each must be properly co-ordinated, and must be made profitable if continuous service for the future is to be expected.

As a matter of equity, it is my belief that the readiness-to-serve charge feature extends from the domestic consumer's meter clear back to the reserve acreage in the field. As to how the producing, transporting and distributing branches of the business ought to share in the readiness-to-serve charge, of course, depends entirely on local conditions. That is, the three divi-

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sions of the business ought to share in the readiness-to-serve charge in the proportion that each contributes to the readiness-to-serve features of the service to the domestic consumer.

SEC. 13 — *Why Readiness-to-Serve Charges are Used More in Electric Than in Other Utilities.*

There are relatively very many more readiness-to-serve charges in use in electric utilities than in other utilities. This is because:

A. The electric art is relatively new. When the electric rate problems had to be worked out there were no old and obsolete rate customs to hamper the work, and it was a much easier matter to apply accurate and scientific principles than has been the case in other older utilities.

B. Obviously, one of the first requirements for a readiness-to-serve charge is an exact and definite relationship of this charge to the capacity of the consumer's service using appliances. Electrical using appliances have a definite fixed capacity not susceptible of variation or change by the consumer and it is, therefore, an easy matter to get an exact and accurate demand basis. With gas, or water, for instance, the various appliances used may vary very largely in their demands on the utility, and can be still more largely varied by adjustments or alterations that the consumer may make from time to time. For this reason dependable connected load data for water or gas consumers are much more difficult to obtain than for electricity. It is in recognition of this engineering fact that most readiness-to-serve charges for water or gas are proportioned to the size of the meter used for measuring the service, rather than for any connected load that may be put on beyond the meter.

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SEC. 14 — *Why There Are Relatively Few Adjudicated Readiness-to-Serve Charges.*

The adjudicated minimum charge monetary allowances, now in force in a large number of public utility rate schedules, have thoroughly established the minimum charge doctrine as a fixed part of American public utility jurisprudence.* If, therefore, little question is made of the minimum charge, less question should be raised regarding the more equitable and more just readiness-to-serve charge. As so well stated by the Louisiana Supreme Court:

> "It may be well to mention that the principle of making this distinct and separate charge for service is the same precisely which underlies the making of a minimum charge by gas, electricity, and water companies for gas, electricity, or water not used, and that the making of a minimum charge may be said to be universally approved." P. U. R. 1916-E, p. 1017, State v. Sloan, June 30, 1916 (139 La., —, 72 So., 428).

The large number of readiness-to-serve schedules now in effect — the majority of these in states having public utility commission jurisdiction — show the widespread use of this equitable method of charging. It is for this reason that it is now little questioned and therefore seldom litigated.

SEC. 15 — *Judicial Recognition of Readiness-to-Serve Doctrine.*

"The question is whether the said 25-cent charge, thus made 'for service,' was made 'for electricity.' Of course, the customer pays the bill in order to have the electricity, and in that sense the charge is made for electricity. But in another sense, it is not made for electricity, but 'for service;' and the bill on its face shows it.

"The reason why this separate charge is made is this. Electricity cannot be economically stored, and yet the supply must

* Tabulation of adjudicated and nonadjudicated minimum charge data in 82-page report made to Hon. Thomas J. Flannelly, District Court of Montgomery County, Independence, Kansas, on "Reasonableness and Legal Right of the Minimum Charge in Public Utility Services." Reprinted by American Gas Institute, 29 West 39th Street, New York City.

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be in constant and immediate readiness on the touch of a button or the turn of a switch. This necessitates the installation and keeping up of a plant and equipment adequate to produce the quantity needed at such times as the demands are heaviest, and not only the quantity which at such times is actually demanded, but also the quantity which might be demanded, and necessarily all that part of this preparation which, at those times when the demands are light, is not called into requisition and especially that part which might, at any moment, be, but never in fact is, called into requisition, is idle and profitless. The expense of the preparation thus not utilized, together with that of making connections with the premises of customers and the furnishing of meters, being more or less fixed, is sought to be provided for by this fixed 25 cents charge, denominated 'for service,' while the current actually produced and consumed is charged for according to meter reading, at a rate which has been arrived at after taking into consideration this service charge. In other words, this service charge does not represent a bonus to the company, but has been devised as a means of more equitably apportioning among the customers of the company the expenses incident to the installation and operation of the plant."

Louisiana Supreme Court, State v. Sloan, P. U. R. 1916-E, pp. 1015-6, June 30, 1916.

"We are of opinion that it is more just and equitable to make what is termed a 'ready to serve' charge in the place of a so-called 'minimum' charge. The ready-to-serve charge is justified on the ground that the utility, after its plant is once constructed and ready for service, may ask each patron to pay a reasonable amount based upon the size of its service pipe, in order to reimburse the utility for the cost of so much of its plant as is required to enable it to at all times stand ready to serve its patrons.

"We have set forth in the schedule which we have prepared the amount of ready-to-serve charges to be paid by its patrons classified on the basis of the size of the service pipe. These charges, we think, will protect the company in its service,

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and at the same time will not impose any unnecessary burden upon its patrons."

Pennsylvania Public Service Commission, Ben Avon Borough v. Ohio Valley Water Co., P. U. R. 1917-C, p. 421, February 12, 1917.

"The costs for domestic, industrial, and public consumers should be met by (1) a fixed service charge, payable whether water is taken or not, and (2) a charge covering proportional or variable costs apportioned on the basis of the quantity of water consumed."

New Jersey Board of Public Utility Commissioners, Re Hackensack Water Co., Rates, P. U. R. 1917-E, p. 179, April 28, 1917.

"In substituting a consumer charge for a minimum charge, the New York Commission, First District, recognized the constant consumer cost which should be borne equitably by all consumers."

New York Public Service Commission, First District, Re New York & Q. E. L. & P. Co., P. U. R. 1917-D, p. 773, April 11, 1917.

"There is much to be said in favor of a minimum or readiness-to-serve charge, and it has been recognized by the commissions and courts of several states, and experience has shown that it is not the poorer class who usually demand the connection and then fail to use the service, but the well-to-do, who have other means of supply and desire the connection only that they may be prepared for emergencies.

"There is a certain amount which the public must pay to enable the utility to operate. If a portion of it is paid in a readiness-to-serve charge, that much less is necessary to be produced from the sale of gas. The readiness-to-serve charge does not yield the company any greater sum, nor cost the consumer any more money. It results only in a different distribution of the burden."

Ohio Public Utilities Commission, Re Ashtabula Gas Co., P. U. R. 1917-D, p. 801, April 24, 1917.

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"In most cases the producers of electric lighting also endeavor to so fix their rates as to take account of these differences in the cost as between the short and long hour consumers. In some cases this is done under the so-called 'readiness-to -serve' system of fixing rates. Under this system the consumer is charged a certain sum per month on his installation in addition to a specific rate per unit of current used. The monthly sum charged for the installation is probably intended to cover all or a part of the fixed charges, and appears to vary with the number of lamps installed. The rate per k. w. hr. for the current used is probably designed to meet the variable expenses. Under this system the consumer really pays the company for holding itself in readiness to serve, and it is on the whole an attempt to charge each consumer on the basis of the actual cost and serving him."

Wisconsin Railroad Commission, in re Appl. La. Crosse Gas & E. Co., 2 W. R. C., p. 24, September 19, 1907.

"These rates, which the applicant desires to put into effect for power purposes, are made up of a fixed charge based on the load connected and a variable charge based on the quantity of current consumed. In this respect the proposed rates resemble those which apparently meet conditions in Rice Lake. They differ in having a lower fixed charge and a somewhat higher meter charge than the theoretical rate. This may not be an altogether undesirable feature, as the proposed fixed charge is not so high but that installations may be encouraged thereby, and, at the same time, the meter rate is sufficiently low to invite long daily use of current. The proposed power rate also recognizes the existence of a difference in the ratio of active to connected load, as between small and large installations. This difference is allowed for by a difference in the fixed rate per connected h. p. instead of by a uniform fixed rate based on different percentages of the connected load."

Wisconsin Railroad Commission, In re Appl. Red Cedar Valley El. Co., 6 W. R. C. p. 762, June 14, 1911.

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"There still appears to be much misunderstanding among consumers regarding the service charge which is incorporated in the rate schedule. To make clear just what connection this charge has with the costs of service, a short explanation of the analysis made of the expenses of a utility in working out equitable rates, it is believed, will not be amiss.

"Examining the expense items incurred by a water utility in conducting its business, it is at once apparent that they differ very much in character. Steam generation expenses differ very much from interest on the investment, etc. Careful scrutiny will reveal that there are certain expenses which are fixed and which do not change to any extent with increase or decrease in the amount of water pumped, but are influenced by the capacity of the plant or the demands upon it. Further, it logically follows that there are other expenses which are directly dependent upon the output of the plant, varying directly with the output. These classes of expenses have been variously designated, but the Commission has frequently used the terms 'capacity' and 'output' to distinguish them. Output expenses, or direct expenses, both material and labor, are those that enter into the product itself (water in this case) and can be charged accurately to a particular article or to a particular operation. Capacity, or indirect expenses, are those that cannot be so charged, but must be distributed over that part of the production indirectly affected by such expenses.

"It must be clear that there are expenses which are occasioned by every consumer; capacity or demand charges on the property used and the cost of running, whether for pumping, distribution, management, etc. In other words, as every consumer is responsible for a certain demand upon the plant, it cannot be denied that the capacity or indirect expenses should be charged to the consumer upon the basis of his demand. The consumer exercises complete control of the service. Even if for considerable periods his demand is nothing, if he is still connected to the mains of the company, the fact that the latter must be ready at all times to supply the service to the consumer up to his maximum capacity, would necessarily imply, it seems, that of the capacity expenses he should be assessed an amount in

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proportion to his maximum demand upon the plant. It is clear that service must be rendered simultaneously with the demand for that service.

"Every consumer in addition to the fact that he is subject to demand service in varying quantities up to his maximum demand, should pay for every cubic foot of water he consumes in addition to the demand or consumer charge. In other words, those expenses, which, as stated, are the cost of running or the constant operation of the plant, whether for pumping, selling, management, etc., must be considered separately from the demand of capacity expenses.

"While there may not be the variation in the demand on a water works that is found in the case of gas or electric plants, there are nevertheless seasonal variations in water pumped. In order to meet the annual peak, it is necessary to provide equipment, hence it is evident that the demand is not negligible in any case. Moreover, the fact that a reservoir or stand pipe is immediately required necessitates the assignment or investment and expenses of such units to demand. The demand is a large factor when we come to consider the distribution system, the size of the mains being determined by the peak demand.

"When it comes to determining the form of rate schedule the question arises, shall the capacity costs and output costs be combined, or shall each be kept separate and distinct? The consumer must pay the capacity cost in either case, hence in most water rate schedules the capacity costs are distributed in the form of a service charge."

Wisconsin Railroad Commission, City of Beloit v. Beloit W. G. & E. Co., 16 W. R. C. pp. 195, 196, 197.

SEC. 16 — *Conclusions.*

1. The primary function of the readiness-to-serve charge is to eliminate discrimination by making all consumers pay for service rendered separate and distinct from gas delivered.

2. The readiness-to-serve charge is more equitable than the minimum charge.

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3. There has been a marked lack of appreciation of the distinction between readiness-to-serve charges and minimum charges, and judicial bodies have frequently erroneously used the two terms interchangeably.

4. It is important to bear in mind that regardless of the name applied, the readiness-to-serve charge never includes any quantity of gas.

5. The determination of the proper amount of a readiness-to-serve charge is more a matter of judgment than a following of rigid rules or mathematical calculations. For a given total income, whatever is derived in the aggregate from the readiness-to-serve charge makes the rate per "M" cubic feet of gas actually used that much less.

6. Up to date (April 9, 1918), there has been but one Supreme Court decision (namely Louisiana) sustaining the readiness-to-serve charge principle.

7. The reason why there has been so little litigation is that the readiness-to-serve charge has had such a widespread use that it is now little questioned, and, therefore, seldom litigated.

8. Readiness-to-serve charges have been judicially allowed in 75 cases before the state public utilities commissions of Arizona, California, Colorado, Illinois, Indiana, Missouri, New Jersey, New York First District, New York Second District, Ohio, Oregon, Pennsylvania, Washington, and Wisconsin.

9. Readiness-to-serve charges are in use in over 250 towns in the United States, for electric, gas, and water service.

DISCUSSION.

VICE PRESIDENT KRICK: Gentlemen, I am sure without going through the formality of a vote that we will extend to Mr. Wyer our thanks for this very interesting and instructive paper. It is now open for discussion. Mr. Stone, do you care to say anything on the subject of the Elimination of Discrimination in Rates by Readiness to Serve Charge? You have had some experience with the Readiness to Serve charge, I understand, at Ashtabula. We would be glad to hear from you.

MR. F. W. STONE: Mr. President, I am not a lawyer and I am not an engineer and as I understand it the "Readiness to

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Serve Charge" is distinctly a legal and an engineering proposition. It seems to me that to a certain extent at least it is a local proposition particularly with reference to the amount of the charge. The amount to be charged is something that must be determined locally. We must also take into consideration the fact that in making the charge we do not always fix what we want to make but merely what we can get and make the best bargain we can.

I think this paper might well have been discussed in connection with the last paper that was presented by Mr. Emmerling, particularly that portion relating to the supplying of gas for heating purposes in the winter time. It seems to me if a readiness to serve charge is made it should eliminate to a certain extent the objections raised in Mr. Emmerling's paper. If we eliminate the peak load consumption for house heating we will not be able to do a profitable business. If we can use a readiness to serve charge we could eliminate the peak load consumption and still do a profitable business. It seems to me that would be one of the ways out of the difficulty which confronts us in this matter.

Also if this scheme advocated by Mr. Wyer of establishing a readiness to serve charge and then an increasing price in proportion to the amount of gas used that would automatically shut off the heating business when it became a peak load business. Whenever the business got to the point where the bills at the end of the month were very much higher the price of the gas would become so expensive that it would automatically reduce the consumption and that would be another way out of our difficulty and would help us out at least partially in the way of a solution of the peak load consumption.

We have a readiness to serve charge of 20 cents per month at Ashtabula established by the Public Utilities Commission of Ohio. I will say to you frankly that it is not enough but we got that much and probably we ought to be thankful for that, since it is a start in the right direction. An analysis of our accounts shows that it materially helps in equalizing the burden. That is it materially helps in making the small consumer,

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— the very small consumer bear his portion of the burden. I refer to the fellow who uses only two or three thousand feet of gas per month. It makes him a profitable consumer or at least it makes him pay his proportion of the operating expenses where otherwise he would not pay his proper proportion.

In conclusion I may say that I am heartily in sympathy with the proposition as suggested by Mr. Wyer but I think the details would have to be worked out in every locality and in each particular case as the particular case might be affected by the local situation.

MR. GEORGE S. GOFF: Mr. President, I would like to say a word on this subject. I am the General Manager of the Crystal City Gas Company, Corning, New York. We are before the Public Service Commission now with this same question. I do not know about the 20 cents suggested by the last speaker. That is pretty light. We get 50 cents for our gas. We charge for 2,000 feet. From the figures we get by way of comparison we find that the 2,000 feet of gas as a minimum charge or a service charge seems to be all right. The Commission has absolute control over us and while we are asking for a little higher rate we not only can sell all the gas we have at 50 cents to domestic consumers but we can sell it for certain industrial purposes. That 20 cent charge made by the Company represented by Mr. Stone I think is too small. We get a dollar.

VICE PRESIDENT KRICK: Mr. Hoover, would you care to be heard on this subject? We would be pleased to hear from you.

MR. H. J. HOOVER: I do not believe Mr. President, I have anything particular to add to what has already been said on this subject.

VICE PRESIDENT KRICK: Is there any other member present who desires to discuss this matter?

MR. F. W. STONE: I think Mr. Goff must have misunderstood me. We have a 34 cent rate net and a 20 cent charge against every consumer in addition to that. No matter whether he uses any gas or not he pays 20 cents per month. I will say frankly that this 20 cents is not enough. We ought to have

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more but at the same time that was the charge that the Public Uilities Commission of Ohio allowed us whether we delivered any gas or not and of course inasmuch as that is all they would allow us we had to be content with the charge of 20 cents at least for the present. It was the first time that a charge of that kind was allowed in the State of Ohio and as I said before it was simply a start but it was a start in the right direction.

MR. GEORGE S. GOFF: I was referring to the readiness to serve charge of 20 cents as being entirely too small regardless of the net rate. Our charge is for 2,000 feet anyhow with the service charge in addition. I probably did not state it correctly. We go on the basis of 2,000. If a consumer does not use a foot of gas we charge for 2,000 feet to begin with.

MR. HENRY C. MORRIS: I will say that in Dallas, Texas, we have a rate of 45 cents and a minimum charge of 50 cents and an analysis of our sales has indicated to us that we have seven thousand consumers who for seven months of the year pay us 60 cents. In other words for a service that costs us $1.00 per month we receive from those customers practically 20 cents or one-third of sixty. It appears to me that the only way to collect from the consumer the cost of service to him is by obtaining a readiness to serve charge or a reservation or a sur-charge or whatever it may be called and an analysis of sales will usually indicate what that sur-charge should be.

MR. J. C. MCDOWELL: Mr. President, in a way I agree with some of the expressions that have been made here that we will have to take what we can get. That may be true but I think we should ask for what is right and persist in our endeavor until we get it. This body of men can get about what they go after if they are only united on the plan. I do not like the suggestion that has been so often advocated of raising the prices to shut off the consumer with a view of restricting consumption because if you do that on account of a very short peak load for a few days in the winter you may lose that consumer who is a valuable customer and a very desirable patron for 80 per cent of the year. You ought to keep him on.

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On pages 9 and 10 of the very excellent paper you will notice that Mr. Wyer calls attention to the readiness to serve charge and suggests that it is sometimes divided into what is known as a "service charge" and "demand charge." Those two elements seem to me to be the way in which the problem is to be handled in the most satisfactory way. One, a service charge, which covers the actual cost to every man alike. Then the demand charge which is an idea, I think, of Mr. Doherty's and which he has been advocating a long time and in which I heartily concur. We are endeavoring to have it inaugurated because we believe it is right. I am sorry he is not here at this moment. I wanted him to be here and say a word to you on this subject. Mr. Fisher, however, has been with us as Manager in the Mid-West for our Companies. He is here and he has this subject more intimately on his mind than I have and I would ask that the Chair call upon Mr. Fisher to say a word about it. Mr. Fisher at present is Chief Technologist, Wichita Natural Gas Company, Bartlesville, Oklahoma.

VICE PRESIDENT KRICK: I am sure we shall all be pleased to hear from Mr. Fisher.

MR. JAMES P. FISHER: Mr. President and Gentlemen:

We have done considerable work in the last six months to determine a proper readiness to serve charge in some communities where we were serving under different conditions and I think the best constructive work that has been done on it in any community is the work of a non-professional body appointed by the Chamber of Commerce of Kansas City to attempt to find a solution of the problem of natural gas service in that city and in the other cities connected with the same line. They have just submitted a report which will be published in the course of a few days in which they advocate as a solution of the difficulties they have been having out there a charge similar in nature to that described by Mr. Wyer in this paper and it is to be put before the various bodies having control of rates with the recommendation of the Chamber of Commerce of Kansas City to have it inaugurated. This will be a rate in which the customary charge is fixed to all users alike at so

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much per meter, — say $6.00 a year and the demand charge will be based on the rate demanded at the highest rate of consumption that the individual consumer has at any time during the year. The rate I believe that will be recommended for natural gas will be 32 cents per foot per hour; that is 32 cents a year for each foot per hour of demand at the highest rate and this will enable them to get natural gas service up to the full amount of their demand at a price of 30 cents per thousand where they are now paying a price of 60 cents per thousand. The effect of this will be as Mr. Wyer points out to distribute the load on the individual consumer. It will reduce his high winter bills which are the burdensome things that bring on the kicks and make all the trouble in domestic service, — it will reduce his high winter bills and it will add the peak of the three or four winter months to the smaller bills that are little considered throughout the year and thus give him a comparatively uniform rate for his gas throughout the entire year and will enable him to burn more gas with less burden and with a better total revenue to the supplying company.

The most difficult point in establishing a rate of this kind is to find out what the individual consumer is going to use at his highest rate of demand and the plan that is involved in this proposition is to install on each meter a demand limit device which will allow the gas to flow through his meter at no greater than the contract rate per hour. He will pay for a device good for ten, fifteen, twenty, twenty-five, thirty or forty cents per hour and will pay 30 cents per year for each foot of demand that this device will allow to pass. Thirty cents per foot for each year will be the amount paid and that will be distributed in twelve equal installments and be presented as a part of his gas bill coupled with the customary charge of a complete readiness to serve service.

VICE PRESIDENT KRICK: Is there any other member present who desires to be heard on this subject? It is certainly one of very great general interest. It is a feature of our business that has been neglected for years and must receive attention from all companies. I join with Mr. McDowell in

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the thought that we must keep on hammering at this proposition until we get it whipped into proper shape. Does anyone else care to be heard?

MR. DONALD MCDONALD: Mr. President, the principle of the readiness to serve charge is undoubtedly an absolutely fair one but the device of installing a check on the meter which will only allow a certain consumption per hour will not accomplish all that ought to be accomplished. If a man can burn fifty feet or we will say a hundred feet an hour and keeps that consumption up for twenty-four hours a day for the period of a year, when you have not enough gas for everybody he does just as much harm to the Company and puts just as great a burden on it as if he burned three times as much for one-third of the time. A readiness to serve charge on electrical apparatus is a matter of seconds. A readiness to serve charge with a gas company plant is a matter of hours and more likely of days. In adjusting a readiness to serve charge it ought to be calculated so as not to put on the poor man and on the small consumer any greater burden than is actually occasioned to the company by standing ready to meet that man's wants. His consumption is fairly uniform. He does not put any much greater burden on the company's service in the winter time than he does in the summer. But when you come to the heating of houses and especially the heating of large houses the consumption in summer is exceedingly small. Most of them have gone away to the Springs but in winter it comes on like an avalanche. It does seem to me as a practical question that the fairest way of adjusting a charge for gas would be this, if a Company is able to furnish during the winter three times as much as the average demand in the summer then allow every consumer to take at the regular rate three times as much gas as he takes during the average summer months. In other words, limit his winter consumption to three times his summer consumption. Now all gas over and above that ought to be sold at a rate so high as either to be prohibitive or else to check that peak load demand to such an extent as will enable the Company first of all to meet its public duty to the mass of its customers and secondly

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to get such revenue as would enable it to extend and improve its service so far as money would improve it.

If any Company represented here today would spend money enough to double its capacity the result would be that you would only use that equipment during about twenty days of the year and you would use it solely for the benefit of about five or six or ten per cent of your customers. Now that being the case the burden of meeting that increased demand should fall on those people who occasion it. The record of the electric people we cannot follow absolutely because as I say their demand is instantaneous. Ours is a question of twenty-four hours. This suggestion of Mr. Wyer is undoubtedly a good one; it is following a good precedent and if it is worked out intelligently and with full knowledge of the rights of the consumers and especially the necessity of the smaller consumer, it ought to afford a great relief to the Companies and it ought to afford a great relief to the public. A relief from that feature of our business which is the worst for the public; that is the times of the year when they cannot get the gas that they need.

Now one of the gentlemen referred to the fact that if people had dual appliances they will use them only during those times that whenever they cannot keep their houses warm with gas. That is perfectly true. But they will not use them until they cannot keep their houses warm and by the time the man with a mansion cannot keep his house warm then the man in the cottage cannot cook for he has no gas. We ought to meet that demand before it comes to the point that the man in the cottage cannot secure gas to cook with, and I believe the proper adjustment of a readiness to serve charge might go a long ways towards accomplishing it. (Applause).

VICE PRESIDENT KRICK: Mr. Garard, do you care to express yourself on this subject?

MR. JOHN M. GARARD: Mr. President, there has been so much said in favor of the gas companies and against the consumer that I fear I might be declared to be out of order if I gave expression to the thought which has come to my mind during this discussion. I think the Gas Companies are their

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own worst enemies. When they put a plant into a town they go along to some little house having four or five rooms and they give that property an inch service or maybe even less than that. Then they go along to this big mansion that Mr. McDonald speaks of and they say: "Now there is a house where we will have to put a two or three inch service." By so doing you encourage that man to burn your commodity and you discourage the little fellow; don't you think that is all foolishness on the part of the Company? Now if you want that big fellow to burn what the little fellow does then give him the same connection. I think you are absolutely wrong when you are blaming it on the consumer — give the little fellow the same connection you give the big fellow and he will have just as much gas as the big fellow will. (Applause).

MR. J. C. MCDOWELL: Mr. President, replying to Mr. Garard I assure you that the inch connection which will supply the four roomed house would not supply my house and still more I may say it would not supply the big mansion to which he refers. He might have a four or a five roomed house and his neighbor a fifteen or twenty roomed house. The result would be that his neighbor with the big house would not use gas at all.

MR. DAVID O. HOLBROOK: May I interrupt the discussion for just a moment to call attention of those present to the fact that the Annual Banquet of the Association is to be held this evening at 6:30 at the William Penn and that it is absolutely necessary that the committee who have in charge the arrangements be able to notify the hotel management as to the number to be expected. It is only fair to the committee, gentlemen, that any of you intending to go to this dinner procure your tickets at the noon recess at the registration booth. You will not only be helping the committee but you will be helping yourselves because if the proper arrangements are not made at the proper time you will get rotten service tonight. We do not know whether it will be good or not but we do know if we have to tell the management at the last minute to provide for a hundred extra men it would not be entirely the fault of the

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hotel management but largely our own. So that if you will get in touch with Mr. Adams and Mr. Way who have the handling of the tickets for the dinner at once you will not only accommodate yourself but also those who have the matter in charge.

VICE PRESIDENT KRICK: Gentlemen, is there any further discussion?

MR. JAMES P. FISHER: Just a moment with reference to a point raised by Mr. McDonald. In every discussion of rates before a Public Utilities Commission or anybody that is susceptible to political influence we hear a great deal said about the rights of the poor man and about lightening the burdens of the poor man and in order to get a rate by it seems that he must be treated not only fairly but a little better than fairly and as a result of that situation in all these years we have been carrying a great deal of idle equipment and a great many meters at a very considerable expense measured by the actual revenue which we get from this class of consumers. It has been a very serious burden on all of the various gas companies. Primarily, we are all in the business to make a revenue which will justify the investment we have in it and as Mr. Wyer points out in his paper the proper way to distribute the burden to produce that revenue is in exactly the proportion to which the consumer costs for the service. This system of a demand limit charge makes the man who wants a large flow of gas for heating his house only for a short period of the year, instead of paying you your standard rate per thousand for those few hours and leaving your system idle the rest of the time he pays you a revenue which will justify the fixed charges on that much of your plant for the entire year. Under the form of a demand charge the poor man who has a little four roomed house and only uses a small amount of gas in the winter time has a very light demand charge made upon him which is not burdensome to him and he gets for the gas actually consumed a lower price per thousand than you could possibly afford to sell it to him for if you figured only on the gas consumed during the winter season. The price that each man pays is

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exactly for the thing that he buys from you and it is at a price at which you can afford to sell it to him.

Now the matter of hourly regulation is exactly the thing we want in the gas business just as the regulation in seconds is the thing that they want in the electric business. If we can get our winter day over the peak of the curve at nine o'clock in the morning and over the peak of the curve at five thirty in the afternoon we will have very little trouble with our service and the man who asks for his hourly demand for gas at these particular hours when people are accustomed to burn more than at any other time has to pay a premium for the extra expense to which he puts you in the form of a demand charge and he will find ways to limit himself in the consumption of gas and in the demand for service at the time which hits your supply the hardest, namely, your peak hours of nine o'clock in the morning and five thirty in the afternoon.

MR. F. W. STONE: In connection with what has been said by some of the speakers here this morning we would judge from the record as given here today that the rich man was the fellow who uses the gas and that he was the big consumer and the poor man uses a very small amount of gas. In other words the amount of gas a man uses to a certain extent is proportionate to his income. While we generally have that impression the facts do not bear out a statement of that kind. I had occasion to make an analysis of the accounts of two gas companies, one in a manufacturing town of about eight or nine thousand people where they had 2,600 accounts on their books, — a western Pennsylvania town doing the ordinary business that a western Pennsylvania town does, and another town of 25,000 people where they had 6,000 accounts on their books. We had occasion to go back over the ledgers and find out the income of one out of every five customers just taking the ledger as the names of the customers appeared upon it so that we would get an average of about the financial situation of the customers as they appeared upon the ledger. The facts of the case are as disclosed by that analysis that the rich man was not the man who used the most gas. The fact of the mat-

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ter is that the very poor man and the very rich man use about the same amount of gas. We figured it out this way. That the very rich man had plenty of help in his house and he thought if it did not cost him any more to have his furnace fired and it was not any burden on him but that the man who did the chores around the house or a maid or whoever did the rough work about the house they could shovel in the coal and carry out the ashes and it did not entail any extra work to him and the consequence was that he burned the coal for heating his mansion and he used electric light for lighting it and he used gas for just whatever cooking was necessary and that was about the limit of his consumption on the average. The very poor man used gas for cooking and used coal for heating because he felt that the coal would be cheaper and he could get along that way. We found from an analysis of these accounts that the best customer of the gas company and the man who used the most gas was the thrifty and well to do mechanic. The fellow who was making good wages and had a very good income but whose wife did her own work and in order to make it easy for the wife to do the work he would use gas for cooking and lighting and heating and for everything around the house where it was possible to use gas and that he was the fellow who was really the big consumer of gas. So that all of this talk that has been indulged in here this morning about the man heating his mansion being the big consumer of gas is not borne out by the facts, at least so far as our experience goes.

MR. H. C. MORRIS: Mr. President, an analysis of the gas sales in a town of 135,000 indicated that 70 per cent of the customers only used 30 per cent of the gas and that the remaining 30 per cent of the customers used 70 per cent of the gas. That is domestic consumption only.

VICE PRESIDENT KRICK: Mr. Fisher, before we close our morning session would it be too much to ask on behalf of the Association in connection with the discussion of this very interesting subject that you submit for inclusion in our publication of the proceedings of this Annual Meeting an illustration

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of the method by which the demand limit charge and the readiness to serve charge is worked out showing the equitable basis which results from such method?

MR. JAMES P. FISHER: Yes I shall be very glad to do so.

VICE PRESIDENT KRICK: We would all appreciate it if you will do it.

MR. JAMES P. FISHER: I will not be able to give a specific illustration of the Kansas City situation until such time as it has been released for publication. I am just saying a word in chamber here at this time but within a week or so it will be ready to be released so that it can be incorporated into the proceedings.

VICE PRESIDENT KRICK: Exactly; that is just what I had in mind.

MR. JAMES P. FISHER: I would be glad to work the thing out as a working example for the benefit of the membership.

VICE PRESIDENT KRICK: Of course the remarks you have made here will in due time be forwarded to you for revision and correction and you can then add what you desire in the way of an illustration of the valuable suggestion you have made.

MR. J. C. MCDOWELL: Mr. President, as I understand he may amplify his remarks if he desires.

VICE PRESIDENT KRICK: That is the thought I have in mind, Mr. McDowell. We will ask him to present whatever he may desire to say on this subject and as fully as he cares to make it, so that it may be incorporated into the printed proceedings. Mr. Wyer, do you care to close the discussion?

MR. SAMUEL S. WYER: I believe I have nothing further to say.

VICE PRESIDENT KRICK: The time has arrived for our noon recess but before announcing it I desire to say something that no doubt will be of interest to you all, and that is, the special feature of the program for the afternoon session.

First we will have a most interesting paper presenting a study of the methods and results obtained in the drilling of the deepest well in the world. The subject of the paper is "The Deepest Well in the World and the Next Deepest in America",

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presented by Dr. I. C. White the well known State Geologist of West Virginia. This will be followed by a discussion in which leading representatives of the various oil companies will participate. It is expected that this paper and its discussion will consume from an hour to an hour and a half.

Following the discussion we will have with us Mr. A. C. Bedford, Chairman of the Petroleum War Service Committee, and Mr. Requa, Director of the Oil Division of the United States Fuel Administration, and many Representative Oil Men of the Appalachian Division. Mr. Bedford will act as Chairman of the joint meeting of the Natural Gas and Oil men and the program will be turned over to him. The remainder of the afternoon will be devoted to a consideration of matters of interest to the oil industry. All members of this Association will be interested in the proceedings.

And thereupon on motion duly made, seconded and carried the Association recessed until two P. M. of same day.

FIRST DAY — AFTERNOON SESSION.

WEDNESDAY, MAY 22ND, 1918.

PRESIDENT GUFFEY: Gentlemen, you will please come to order. I have the privilege and the pleasure of introducing to you Dr. I. C. White, who will address us on the subject, "The Deepest Well in the World, and the Next Deepest in America." You all know Professor White (applause).

Dr. Israel C. White, State Geologist of West Virginia, Morgantown, West Virginia, then presented the following paper:

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THE DEEPEST WELL IN THE WORLD AND THE NEXT DEEPEST IN AMERICA.

By Dr. Israel C. White.

PREVIOUS PUBLICATION

At the annual meeting of the Geological Society of America December 30th, 1912, the writer presented a "Note on a Very Deep Well near McDonald, Pennsylvania", and the same was published in Volume XXIV, pages 275 to 282, under date of June 10th, 1913. At that time the well in question, which is located on the R. A. Geary farm, about 5 miles northwest from McDonald, Pennsylvania, near the line between Allegheny and Washington Counties, had attained a depth of 6299 feet, and was still drilling. As related in the former "Note", the boring was executed by the Peoples Natural Gas Company, of Pittsburgh, Pennsylvania, an organization which, together with the Hope Natural Gas Company, a coworker in deep drilling, is subsidiary to the Standard Oil Company of New Jersey. Mr. John G. Pew of Pittsburgh is President of the Peoples Natural Gas Company and Capt. L. F. Barger of the same city was General Manager and in immediate charge of field operations during the period in which the Geary well was drilled, and to their courtesy and liberal views in their attitude toward geologic science, we are indebted for the record of this very deep boring.

As stated in the previous publication, this well is located on the Candor Dome described in the Burgettstown Folio of the U. S. Geological Survey by E. W. Shaw and M. J. Munn, a structural feature in the rocks of the region where the several sands of the lower Pennsylvanian, Mississippian, and upper Devonian beds had produced large quantities of natural gas, but in the course of 20-odd years of production had become practically exhausted on account of the great decline in rock pres-

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sures through continued use of the gas. It was in hopes of developing still deeper and virgin horizons of natural gas that the drilling of the Geary well was undertaken on the summit of the Candor Dome where several successive gas sands had already furnished large quantities of this matchless fuel.

After overcoming many difficulties, including the loss of a bailer and many hundred feet of steel line in the hole, pulling casing and reaming, to shut off additional water found at 6,520 feet, as also the loss of two strings of drilling tools, only one of which could be recovered from a depth of nearly 7,000 feet, the lower string of tools was left at the side of the hole which was drilled past them and the tools cased off with 7,214 feet of 4½-inch casing welded into one continuous tube by the oxyacetylene flame, and constituting probably the longest string of casing ever set in any boring anywhere in the world. After the salt water struck at 6,520 to 6,530 feet had been successfully shut off at 7,214 feet and the missing set of tools safely side-tracked into the wall of the well, the lower joints of this very long casing tube under a water pressure of nearly 3,000 pounds to the square inch collapsed around the drilling tools, and as there was of course a curve in the bore hole opposite the lost tools, the drilling set could not be withdrawn, and thus the second deepest hole ever yet sunk in the new world (and exceeded only by the Czuchow well — 7,349 feet — in the old world) was plugged beyond hope of recovery at a depth of 7,248 feet, in the summer of 1917, after more than 6 years of continuous work, and the expenditure of very many thousands of dollars in an effort to reach the "Clinton" oil and gas zone of Ohio which has proved gas-bearing and petroliferous practically from the Ohio River in Scioto County northward to Lake Erie in Cuyahoga County. This gas horizon was termed "Clinton" by Dr. Edward Orton, Sr., when it was first discovered, and it will probably continue to retain the original name, but the writer has always regarded it as more probably the equivalent of the White Medina Sandstone horizon immediately below the true Clinton of the New York series, and in this conclusion Prof. J. A. Bownocker, the present State Geologist of Ohio, concurs.

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The record of this second deepest well in America and third deepest in the world affords so much of geologic and stratigraphic interest that it is here given in full with the kind permission of Messrs. Pew and Barger. It reads as follows:

R. A. GEARY WELL RECORD, No. 1770 OF THE PEOPLES NATURAL GAS COMPANY.

Located five miles northwest from McDonald, Pennsylvania; beginning 130 feet below the crop of the Pittsburgh Coal; well mouth approximately 1,050 feet above tide.

	Thickness Feet.	*Total Feet.*
Conductor	16	16
Unrecorded (13" casing set at 232')	434	450
Lime	20	470
Slate	125	595
Middle Kittanning Coal (water at 600')	5	600
Unrecorded	134	734
Salt Sand (gas at 760' and 912')	216	950
Pencil Cave (10" casing set at 953')	3	953
Big Lime	29	982
Big Injun Sand (gas at 1,052')	259	1,241
Unrecorded	137	1,378
Squaw Sand (gas at 1,379')	14	1,392
Unrecorded	218	1,610
Sand (Berea)	12	1,622
Unrecorded	172	1,794
Hundred-Foot Sand (gas at 1,797')	23	1,817
Unrecorded	93	1,910
Thirty-Foot Sand (gas at 1,912')	15	1,925
Unrecorded	43	1,968
Gordon Stray Sand (8¼" casing set at 1,969')	3	1,971
White slate	1,019	2,990
Lime	220	3,210
White slate	230	3,440
Lime	10	3,450
White slate	650	4,100
Sand and lime (Benson, Bradford?)	70	4,170
White slate	350	4,520
Black slate	30	4,550
White slate	650	5,200
Black slate	120	5,320
Black shale	200	5,520
White slate	140	5,660

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			Thickness Feet.	Total Feet.
Limestone ..... 20′ Black lime 108		*Selinsgrove*	128	5,788
Black slate (*Marcellus*)			220	6,008
Black lime ..... 15′ Flint 22		*Corniferous*	37	6,045
Gray sand (6⅝″ casing, 6,053′) (water and gas, 6,045′) ... 155′ Brown sand ..... 60 White sand (water, 6260-6265′) 10 Brown sand 45		*Oriskany*	270	6,315
Black lime ..... 80′ Sand and black flint... 10 Black lime 110	200′			
White sand, Stormville Conglomerate (Coeymans) (gas, 6,522′; water, 6,520 to 6,530 feet) 15		*Helderberg.*	385	6,700
Black limestone ..... 80′ Gray limestone (*Bossardville*) 90	170			
Rock salt ..... 8′ Lime and sand..... 67 Rock salt ..... 10 Limestone ..... 45 Rock salt ..... 40 Lime and sand..... 20 Rock salt ..... 5 Limestone ..... 5 Rock salt ..... 5 Limestone ..... 20 Rock salt ..... 5 Limestone (tools lost).. 15 Limestone and sand.... 95 Salt and lime shells.... 15		*Salina Salt Series...*	340	7,040
Sand and lime, Salina and Niagara, to bottom.....			208	7,248

Casing Record:

16″ hole to 232′; cased to that point with 13″ casing;
13″ hole to 953′; to that point 10″ casing;
10″ hole to 1,969′; 8¼″ casing to that point;
8¼″ hole to 6,053′; 6⅝″ casing to that point, weight, 68 tons;

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6¾" hole to 6,315'; 4½" casing to that point, weight 46 tons;
Then pulled 4½" casing and reamed, and drilled hole to 7,214', when 7,214 feet of 4½" welded casing was set.

This detailed record may be summarized as follows, beginning at the base of the Pittsburgh Coal 130 feet above the derrick floor:

		Thickness Feet.	*Total Feet.*
Conemaugh Series ..... 580'			
Allegheny Series 284	Pennsylvanian..	1,080	1,080
Pottsville Series 216			
Mauch Chunk ..... 3'			
Big Lime ("Mountain, Greenbrier")..... 29	Mississippian...	672	1,752
"Big Injun", "Squaw", and "Berea" Sands 640			
Catskill, (including Venango Oil Sand Group), Chemung, Portage, Hamilton, and Marcellus beds..		4,386	6,138
Corniferous Limestone		37	6,175
Oriskany Sandstone.....		270	6,445
Helderberg		385	6,830
Salina Salt Series.....		340	7,170
Salina Shales and Niagara (Clinton?).....		208	7,378

It is regrettable that this boring could not have been sunk a few hundred feet deeper, since the horizon of the "Clinton" oil and gas zone could not have been more than 100 to 300 feet below where the tools were so successfully imprisoned, and reluctantly abandoned by Mr. Pew and his associates.

The demonstration of the existence of commercial deposits of rock salt in the Salina Series extending in unbroken sheets from Cleveland past Akron (where its presence had already been demonstrated) to the vicinity of Pittsburgh and probably many miles southward, is an accomplishment well worth all of the cost of the boring, to say nothing of the great addition to the sum of stratigraphic and geologic knowledge otherwise forever to remain a sealed book except for the labor and money expended thereon by the men of broad vision and ample means who had at their command the unlimited resources of the Standard Oil Company of New Jersey. To Mr. A. C. Bedford,

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Chairman, and the other officers of this great corporation, geologic science is indebted for this rich contribution to the sum of human knowledge. It is barely possible that in addition to the vast quantity of common salt, or sodium chloride, in these great underground deposits, some of the potash salts, potassium chloride and potassium sulphate, may also exist and will be found interbedded among these other saline products.

Opportunity was afforded the experts of the U. S. Geological Survey to test this deep well for temperature observations and the Peoples Natural Gas Company also made some temperature tests on its own account, these latter being given in the Geological Society of America publication referred to above.

The temperature measurements of C. E. Van Orstrand, Physical Geologist of the U. S. Geological Survey, have been courteously submitted by him to the writer by the kind permission of the Director of the U. S. Geological Survey, for publication in connection herewith. This interesting series of measurements and Mr. Van Orstrand's accompanying explanatory letter read as follows:

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
WASHINGTON.

JANUARY 8, 1918.

PROF. I. C. WHITE,
State Geologist,
Morgantown, West Virginia.

DEAR PROFESSOR WHITE:

In response to your letter of December 19:

Inclosed are temperature data of the McDonald well. The observations are my own except one at the 6,000-foot point which was made by Doctor John Johnston. The slight drop in temperature near the bottom of the well is due to gas, and also to water from a higher level.

Very truly yours,

(Signed) C. E. VAN ORSTRAND,
Physical Geologist.

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TEMPERATURE MEASUREMENTS OF R. A. GEARY No. 1770 WELL.

(Observations were made November 16-20, 1914; Reading at 6,000 feet taken by Dr. John Johnston, November 30, 1912; thermometer in water at 4.850 feet).

Depth.		Mean Temperature.	
Meters.	Feet.	° Centigrade.	° Fahrenheit.
30.5	100	13.9	57.0
106.7	350	15.1	59.2
182.9	600	16.2	61.2
259.1	850	17.5	63.5
335.3	1,100	18.0	64.4
411.5	1,350	19.2	66.6
487.7	1,600	20.8	69.4
563.9	1,850	22.3	72.1
640.1	2,100	24.6	76.3
716.3	2,350	26.1	79.0
792.5	2,600	28.0	82.4
868.7	2,800	29.3	84.7
944.9	3,100	31.2	88.2
1,021.1	3,350	33.6	92.5
1,097.3	3,600	36.0	96.8
1,173.5	3,850	38.2	100.8
1,249.7	4,100	40.2	104.4
1,325.9	4,350	41.7	107.1
1,402.1	4,600	43.6	110.5
1,478.3	4,850	45.1	113.2
1,554.4	5,100	49.5	121.1
1,592.6	5,225	51.8	125.2
1,630.7	5,350	53.2	126.8
1,706.9	5,600	56.3	133.3
1,783.1	5,850	58.9	138.0
1,828.8	6,000	60.0	140.0
1,859.3	6,100	60.7	141.3
1,935.5	6,350	59.3	138.7
2,011.7	6,600	62.3	144.1
2,065.0	6,775	63.2	145.8
2,126.0	6,975	62.7	144.9

Mr. Van Orstrand, with improved temperature reading and recording devices, was to have been given an opportunity to make other temperature tests before the boring was abandoned, but the unhappy accident mentioned above prevented this very desirable accomplishment.

The water found at 6,260 feet was analyzed, the results of which are recorded in the former publication by the writer.

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The apparent decrease in temperature in descending, like that from 6,100 feet to 6,350 feet, is due to the cooling effect of natural gas flows struck between such horizons, the expansion of the gas taking up heat.

THE DEEPEST WELL IN THE WORLD.

The deepest well in the world is the one put down by the Hope Natural Gas Company on the Martha O. Goff farm

Deepest Well in the World, Martha O. Goff, No. 4190, of the Hope Natural Gas Company, 8 miles northeast of Clarksburg, Harrison County, W. Va., and the men who drilled it; namely, (from left to right): James B. Wells, Tool dresser; Charles Welch, Foreman; F. C. Davis, Tool dresser; A. L. Rawlins, Driller; E. C. Brummage, Driller, and John H. Williams, Superintendent.

about 8 miles northeast from Clarksburg, Harrison County, West Virginia. Through the courtesy of Messrs. John B. Corrin and John G. Pew, Vice-Presidents of the Hope Company, and John H. Williams, Superintendent of the drilling department, the record of this deepest of all borings, together with a sketch map showing its location, photos of the derrick, cable, drilling crew, etc., are given herewith. The well was begun with the idea of testing for deeper oil or gas horizons

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than any hitherto encountered in West Virginia, the intention being to drive it to the horizon of the "Clinton" (Medina) petroliferous Sand of Ohio, if possible. The Devonian Shales, however, having thickened over a thousand feet more than expected, this boring will most probably be stopped after penetrating and testing the Oriskany Sandstone, now only a few feet (probably not more than 20 to 30) below the present bottom (7,386') of the well where it is temporarily delayed with a fishing job, the steel cable having parted over 5,000 feet down, thus leaving the tools and 2,000 feet of cable in the hole. Mr. John H. Williams (to whose great skill and accomplishments in the art of drilling, aided by the splendid work of his resourceful crew, geology is indebted for the deepest well ever drilled) thinks that he can soon clear the well of the broken cable and tools, and then sink the same several hundred feet deeper, even to 8,000 feet or more, the only trouble being to find a cable of the right strength and quality, some of them having parted with only a few hours' use. The complete history of this remarkable well is given in the following summary and record prepared by John B. Corrin and John H. Williams:

STATISTICS CONCERNING DEEP WELL DRILLED BY HOPE NATURAL GAS COMPANY.

LOCATION:

On the Martha O. Goff farm of 620 acres in Simpson District, Harrison County, West Virginia, on the waters of Owens Fork of Booths Creek, 4½ miles northeast of the town of Bridgeport, on the main highway from Fairmont to Clarksburg, W. Va. Well accurately located on the accompanying topographic sheet.

ELEVATION:

Location made for well March 3rd, 1916, at a point 1,164 feet above sea-level, and 200 feet below the level of the Pittsburgh seam of coal.

SUMMARY OF DRILLING:

Drilling was commenced April 19, 1916, and on March 4, 1918, a depth of 7,386 feet had been reached, thus exceeding by 37 feet the depth of the well hitherto known as "the deepest well in the world," located at Czuchow in Germany. Approximately 400 days have been spent in actual drilling, the remainder of the time the well has been shut down for repairs to rig, boilers, cables, etc.,

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waiting for materials, minor fishing jobs, taking of temperatures, cleaning out cavings from the hole, etc. Fortunately, no serious fishing jobs have been encountered. The last known sand passed in the well was the Bayard Sand, at depth of 2,300 to 2,310 feet. Following is record of the various formations, and the dates showing progress of the work.

RECORD:

	Top Feet.	Bottom Feet.	
Native Coal (Elk Lick)....	83	86	
Little Dunkard Sand.....	170	186	
Big Dunkard Sand.....	305	336	
Gas Sand	436	446	
First Salt Sand.....	690	815	
Second Salt Sand.....	860	880	
Maxton Sand	1,025	1,040	
Little Lime	1,183	1,194	
Pencil Cave	1,194	1,210	
Big Lime	1,210	1,275	Gas at 1,253 ft.
Big Injun Sand.....	1,275	1,394	Water at 1,304 ft.
Squaw Sand	1,410	1,428	
Berea Sand	1,512	1,540	
Gantz Sand consolidated with Fifty-Foot	.....	.....	
Fifty-Foot Sand.....	1,748	1,885	Gas at 1,749 ft. and
Thirty-Foot Sand	1,900	1,980	1,757 ft.
Gordon Stray Sand.....	2,090	2,097	
Gordon Sand	2,130	2,142	
Fourth Sand	None		
Fifth Sand	None		
Bayard Sand	2,300	2,310	June 23, 1916.
Slate shells	2,310	2,830	
Hard lime	2,830	2,893	
Slate and Lime shells.....	2,892	3,125	
Hard lime	3,125	3,145	
Slate shells	3,145	3,222	
Hard lime	3,222	3,240	
Slate shells	3,240	3,480	
Hard sand	3,480	3,505	
Slate	3,505	4,166	
Lime shells (Benson Sand)	4,166	4,167	With puff of air
Slate	4,167	4,425	(gas).
Lime	4,425	4,500	Sept. 8, 1916.
Slate and shells.....	4,500	4,790	
Lime	4,790	4,850	
Slate shells	4,850	5,200	

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	Top Feet.	Bottom Feet.	
Slate shells at.....		5,700	December 23, 1916.
Slate shells at.....		5,775	January 6, 1917.
Dark slate	5,840	5,995	
Lime shells	5,995	5,998	
Dark slate	5,998	6,210	
Light slate	6,210	6,235	February 16, 1917.
Lime	6,235	6,265	
Dark slate	6,265	6,272	
Lime	6,272	6,280	
Dark slate	6,280	6,294	
Lime	6,294	6,304	
Dark slate	6,304	6,318	
Lime	6,318	6,330	
Dark slate	6,330	6,360	March 23, 1917.
Lime	6,360	6,380	
Dark slate	6,380	6,385	
Lime	6,385	6,395	
Dark slate	6,395	6,420	
Lime	6,420	6,426	
Dark slate	6,426	6,438	
Lime	6,438	6,447	
Dark slate	6,447	6,465	
Lime	6,465	6,470	
Dark slate	6,470	6,500	April 13, 1917.
Black slate	6,500	6,505	Shut down 2 months,
Black lime	6,505	6,510	repairs to rig, sand
Black slate	6,510	6,532	reels, waiting for
Dark slate	6,532	6,580	cable, etc.
Dark slate	6,580	6,625	
Hard shells	6,625	6,627	
Brown shale	6,627	6,640	
Hard shells	6,640	6,645	
Black slate	6,645	6,660	June 29, 1917.
Black shale	6,660	6,676	
Black sand	6,676	6,680	
Hard lime	6,680	6,690	
Dark slate	6,690	6,714	
Dark lime	6,714	6,747	
Hard shell	6,747	6,750	
Slate	6,750	6,755	July 7, 1917.
Dark slate	6,755	6,775	
Hard sand shells.....	6,775	6,780	
Black shale	6,780	6,800	
Black slate	6,800	6,823	

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	Top Feet.	Bottom Feet.	
Hard lime	6,823	6,865	July 13, 1917.
Lime shells	7,057	7,069	Shut down 1½ mos.
Hard sand	7,069	7,071	
Hard lime	7,069	7,075	November 2, 1917.
Lime	7,081	7,093	November 16, 1917.
Hard lime	7,093	7,097	
Hard lime	7,097	7,110	
Slate and shells	7,110	7,150	December 21, 1917.
Slate	6,150	7,160	
Hard lime	7,160	7,162	
Lime shells	7,162	7,176	
Gritty shells	7,176	7,190	
Slate	7,190	7,225	January 4, 1918.
Slate	7,225	7,232	
Hard shell	7,232	7,245	
Black slate	7,245	7,251	
Slate and shells	7,251	7,256	
Hard lime	7,256	7,261	
Dark hard lime	7,261	7,266	
Black slate	7,266	7,280	
Hard shells	7,280	7,282	
Slate	7,282	7,290	
Soft slate	7,290	7,295	
Soft black slate	7,295	7,300	January 18, 1918.
Black slate	7,300	7,345	
Gritty lime	7,345	7,363	February 1 to March 1, 1918, shut down taking temperatures and repairing rig.
Hard flinty limestone, *Corniferous*, to bottom	7,363	7,386	March 1-4, 1918. March 4, 1918, cable parted 2,000 feet above bottom.

SIZE OF HOLE:

16 in. in diameter to depth of 217 ft.
13 in. in diameter from 217 ft. to 1,238 ft.
10 in. in diameter from 1,238 ft. to 2,307 ft.
8 in. in diameter from 2,307 ft. to 7,071 ft.
6 in. in diameter from 7,071 ft. to present depth.

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CASING:

217 ft. of 13-in. casing, set in slate.
1,238 ft. of 10-in. casing, set in Big Lime.
2,307 ft. of 8¼-in. casing, set in Bayard Sand.
1,666 ft. of 6-inch liner, set in well at 5,405 ft. to 7,071 ft., to protect hole from cavings.

RIG:

Standard (wood), 96 ft. high, with 22-ft. base of extra heavy timbers, Bull wheel shaft 24 in. in diameter, with Bull wheels 10 ft. in diameter, triple tug, having two 10 ft. brake wheels, with 14 in. brake band on one side, 10 in. on other side; three sets of bull

wheels have been used. Band wheel is 14 ft. in diameter with 13 in. face, triple tug, carrying belt 18 in. wide, 150 ft. in length. Sand reel has 6 in. steel shaft, with 16 in. friction and brake wheel, and weighs approximately 8,000 lbs., two of these sand reels having been used. Walking beam is probably the heaviest and largest piece of timber ever used for this purpose, with Pitman, connected to the walking beam, also of unusual size and weight. Crown pulley (top of rig) has 7 in. steel shaft, and weighs 1,200 lbs. 4½ Standard rig irons were used to depth of 4,500 ft., then replaced by special extra heavy rig irons (7½ in.) which have been used to present depth. Rig has been reinforced and repaired from time to time. All work of erecting and repairing rig has been under the

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direction of George H. Stanfield, of Clarksburg, W. Va., Superintendent of Rig Building for the Hope Natural Gas Company.

BOILERS:

One 25 hp. Acme, used from top of hole to 4,500 ft.
One 25 hp. Brennen, coupled with the Acme at 4,500 ft., the two boilers then being used from 4,500 ft. to 7,300 ft.
One 25 hp. Acme, put on at 7,300 ft., the three boilers then being used from 7,300 ft. to the present depth.

ENGINES:

One 12 x 12 Acme, 25 hp. used from top to 4,500 ft.
One 16 x 16 Oil Well Supply, 80 hp., replaced the Acme at 4,500 ft. and has been used from that depth to present time.

CABLES:

One second-hand Manila, 2¼ x 700 ft., drilled to 150 ft.
One second-hand Manila, 2¼ x 700 ft., drilled 150 ft. to 615 ft.
One new Manila, 2¼ x 2,800 ft., drilled 665 ft. to 2,290 ft.
One new Wire, ⅞-in. x 4,000 ft., drilled 1,070 ft.
One new tapered Wire, ⅞ x 1 x 1⅛ x 1⅛ x 10,000 ft., drilled 1,220 ft.
One new tapered Wire, ⅞ x 1 x 1⅛ x 1⅛ x 10,000 ft., drilled 525 ft.
One new tapered Wire, ⅞ x 1 x 1⅛ x 7,350 ft., drilled 790 ft.
One new Wire, 1-in. x 7,000 ft., drilled 32 ft., then used 48 days on cleaning out work.
One new Wire tapered, ⅞ x 1 x1⅛ x 1¼ x 10,000 ft., used one day, broke, and was fished out of well.
One second-hand Wire, 1-in. x 5,000 ft., used one day.
One second-hand Wire, 1-in. x 7,000 ft. used one day.

TOOLS:

Drilled to 6,500 ft. with string tools containing Stem 34 ft. in length, 5½-in. diameter.
Drilled from 6,500 ft. to 7,071 ft. with string tools containing Stem 40 ft. in length, 4½-in. diameter.
Drilled from 7,071 ft. to 7,386 ft. with string tools containing Stem 40 ft. in length, 4¼-in. diameter.

TO WHOM CREDIT IS DUE:

John H. Williams, Clarksburg, W. Va., Supt. of Drilling Department of Hope Natural Gas Co., who has directed the work since its commencement, and still has charge.
A. L. Rawlins, Driller, at well since same was commenced.
L. P. Williams, Driller, from 175 ft. to 6,500 ft.
John L. Richey, Driller, from 6,500 ft. to present depth.
George Groves, Driller, from top to 175 ft.

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TEMPERATURES:

Depth.		Mean Temperature.	
Meters.	Feet.	° Centigrade.	° Fahrenheit.
30.5	100	13.11	55.6
61.0	200	13.51	56.3
91.4	300	14.15	57.5
121.9	400	14.97	58.8
152.4	500	15.67	60.2
182.9	600	16.42	61.6
213.4	700	16.92	62.5
243.8	800	17.49	63.5
274.3	900	18.07	64.5
304.8	1,000	18.51	65.3
335.3	1,100	18.76	65.8
365.8	1,200	18.62	65.5
396.2	1,300	19.18	66.5
426.7	1,400	19.57	67.2
457.2	1,500	19.87	67.8
487.7	1,600	20.01	68.0
518.2	1,700	19.89	67.8
548.6	1,800	21.53	70.8
579.1	1,900	23.13	73.6
609.6	2,000	23.84	74.9
640.1	2,100	24.52	76.1
670.6	2,200	25.19	77.3
701.0	2,300	25.72	78.3
731.5	2,400	26.58	79.8
762.0	2,500	27.2	81.0
914.4	3,000	30.9	87.6
1,066.8	3,500	34.3	93.8
1,219.2	4,000	37.8	100.0
1,371.6	4,500	41.8	107.2
1,524.0	5,000	45.7	114.2
1,676.4	5,500	50.2	122.3
1,828.8	6,000	55.6	132.1
1,981.2	6,500	61.8	143.2
2,133.6	7,000	67.3	153.2
2,209.8	7,250	69.8	157.7
2,228.1	7,310	70.2	158.3

(Temperatures taken by C. E. Van Orstrand, Physical Geologist, U. S. Geological Survey, Washington, D. C.)

Permission to publish these interesting temperature results obtained by Mr. Van Orstrand we owe to the courtesy of Dr. Geo. Otis Smith, the accomplished Director of the U. S. Geological Survey, Washington, D. C. They extend to a depth in

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the earth of 23 feet greater than any others ever made, those at the Czuchow well in Germany having ended at 7,287 feet where a temperature of 182° Fahrenheit was recorded. This temperature, however (182° — 158°), 24° higher than that in the Goff well at practically the same (7,250′) depth, like many other statements from German sources, Mr. Van Orstrand thinks can not be trusted as accurate, and he would treat it as a "scrap of paper" until confirmed by other methods free from possible error, since practically all of the deep well temperatures recorded in this country agree fairly well with the results at the Goff well for corresponding depths; the Wheeling, W. Va., deep well having a temperature of 110.3° F. at 4,500 feet, and the Wm. Bedell deep well near West Elizabeth, Pa., having a temperature of 127° at 5,500 feet, as determined by the late Prof. Wm. Hallock, of Columbia University.

SUMMARY OF RECORD

This long column of deposits might be summarized as follows, beginning at the base of the Pittsburgh Coal, 200 feet above the mouth of the boring:

			Thickness Feet.	*Total Feet.*
Pittsburgh Coal, base of Monongahela Series.....				
Conemaugh Series	600′	Pennsylvanian..	1,150	1,150
Allegheny Series	290			
Pottsville Series	260			
Mauch Chunk	260′	Mississippian...	590	1,740
Mountain (Greenbrier) Limestone	65			
"Big Injun", "Squaw", and "Berea" Sand Group.....	265			
Catskill, containing Venango Oil Sand Group, to base of "Bayard" Oil Sand	770′	Upper Devonian Shales	5,823	7,563
Chemung Shales, containing "Elizabeth", Speechley, Bradford (Benson) and Kane Oil Sand horizons	2,190			
Portage beds	1,207			
Genesee Slate	288			
Hamilton and Marcellus...	1,368			
Corniferous Limestone to present bottom.....			23	7,586

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The great thickness (5,823′) of the Upper Devonian beds, or the measures lying between the Berea Sand and the top of the Corniferous Limestone in the Goff well reveals an unexpected increase in these strata from the region of the Geary well on southward. This thickening is shown graphically on the diagram giving these shales at only 1,775 feet in the Seiberline well just south of Akron, Ohio, 4,386′ in the Geary well, near McDonald, Pennsylvania, and 5,823 feet in the Goff well in West Virginia. The diagram also shows that while the Goff well is 138 feet deeper than the Geary well, yet the latter owing to this great thickening southward penetrated the geologic formations to a depth of about 1,200 feet farther than the Goff, while the Seiberling well (in which the "Clinton" or Medina Sand was struck at 3,500 feet or 1,240 feet below the top of the Corniferous Limestone) had passed through the geologic column near Akron several hundred feet further at 3,749 feet, its total depth, than had the Geary well at 7,248 feet, although the Seiberling well started only (1,622 — 385) 1,237 feet geologically below the Geary well, the base of the Berea Grit coming at 385 feet in the former and 1,622 feet in the latter. Hence, in figuring the depth to Ohio's Clinton Sand at any locality in western Pennsylvania, West Virginia, or southern Ohjo, this thickening of the Devonian Measures must be taken into account.

The author has under preparation a paper soon to be published in one of the West Virginia Geological Survey volumes, giving a more comprehensive treatment of this thickening, based upon the study of a large number of deep well records and with this will be published a map showing by contours the approximate depths of the Corniferous Limestone below the Berea Grit at all points from the Goff well southwestward, westward, and northeastward in the adjoining regions of West Virginia, Ohio, and western Pennsylvania. This contemplated map should serve as a useful guide to the oil and gas operators should any of them, like the Hope and Peoples Companies, undertake to prospect for these deeper sands; viz., the Oriskany and "Clinton" (Medina). It should be stated for the encouragement of any such efforts that although the Hope Company

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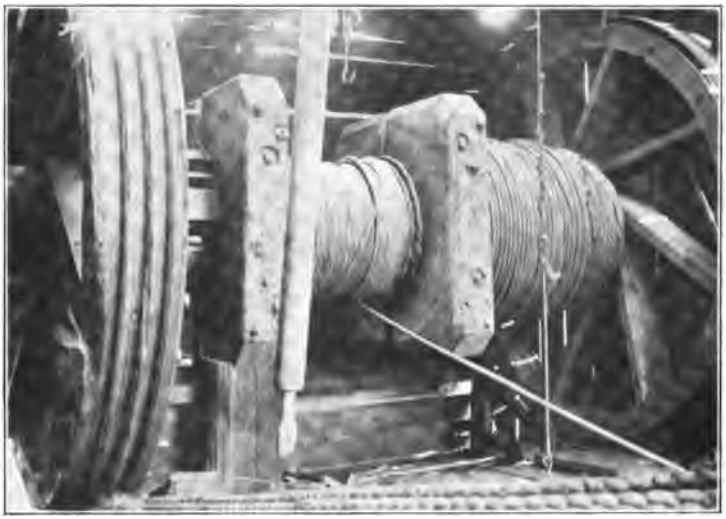
has not yet succeeded in penetrating to the Clinton Sand anywhere in its deep drilling efforts in West Virginia, it has nevertheless succeeded in developing 3 or 4 deep gas horizons below the geologic level of the Bayard Sand, the customary horizon at which most wells have been stopped in West Virginia; viz., at 2,400 to 2,600 feet below the horizon of the Pittsburgh Coal. One of these deep horizons found in Barbour, Harrison, and Lewis Counties, lies about 4,350 feet below the Pittsburgh Coal, and approximately 2,800 feet below the top of the Big Injun



Sand. It is known as the *Benson Sand* (from the farm of J. C. Benson, in Barbour County, where it was first developed at the Hope Company's well No. 3,612), and appears to represent either the "Bradford" or "Kane" Sand horizons of northern Pennsylvania, and is apparently the deep one called "Bradford" found by the Peoples, Philadelphia and other gas companies, in Westmoreland and adjoining counties of western Pennsylvania, at about 3,850 feet below the Pittsburgh Coal, or 2,700 feet below the top of the Big Injun Sand. The volume of the Benson Sand wells yet found in West Virginia is only 300,000 to 800,000 cubic feet, but the rock pressure is 1,800 pounds to

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the square inch, and possibly greater, and hence with the increased price which all natural gas owners trust that this matchless domestic fuel may bring in the near future, it may become profitable to drill many wells down to this deep horizon, especially any that have become greatly depleted in higher sands.

Another sand 300 feet above the Benson has been developed in the M. D. Reiley well No. 5,048 of the Hope series, Barbour County, and this may possibly represent the true Bradford Sand, while the Benson horizon found in the same well at 4,403 feet may be the Kane Sand.

Then, in another well near Good Hope, Harrison County, a productive horizon yielding over a million cubic feet daily has been found by the Hope Company at 1,570 feet below the top of the Big Injun Sand, or practically 3,000 feet below the Pittsburgh Coal in that region. This may possibly represent the Elizabeth Sand of Pennsylvania, since in Harrison County, West Virginia, the Gordon Sand comes in round numbers 800 feet below the top of the Big Injun; the Fifth, 900 feet; and the Bayard, 1,000 feet below the same horizon, or it may represent simply a local lens of coarser sand in these Chemung beds of the Upper Devonian.

The *Oriskany Sandstone* lying just below the Corniferous Limestone and which was 270 feet thick in the Geary well, but filled with salt water, may possibly be another source of gas on the larger folds or anticlinals of West Virginia and western Pennsylvania, and this should be accessible within depths of 4,500 to 5,000 feet along the Ohio River between Beaver and Parkersburg.

DISCUSSION.

PRESIDENT GUFFEY: I am sure every producer here, whether he is a producer of oil, or a producer of natural gas, will join with me in extending a vote of thanks to Professor White for his very interesting and instructive paper. The meeting is now open for discussion on the paper just read. The paper has been prepared with such care, and has dealt so thoroughly with the subject, that it seems it needs no further discussion.

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Joint Meeting

of the

Oil Producers of the Appalachian Field

and

The Natural Gas Association of America

held at

Chamber of Commerce, Pittsburgh, Pa.

on the afternoon of

Wednesday, May 22, 1918

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AFTERNOON SESSION.

WEDNESDAY, MAY 22, 1918.

The Joint Meeting of the Oil Producers of the Appalachian Field and The Natural Gas Association of America was held at the Chamber of Commerce, Pittsburgh, Pa., on the afternoon of Wednesday, May 22, 1918.

Hon. Joseph F. Guffey, President of The Natural Gas Association of America, in calling the meeting to order, said:

At this joint meeting of the Oil Producers of the Appalachian Field and The Natural Gas Association of America, I am going to take the liberty, as well as the pleasure, of asking one of the best known men in the oil and gas business to take charge of the proceedings for the balance of the afternoon session. He is a gentleman who needs no introduction to you. He has done much during the past year to serve his country with credit and distinction, as well as the industry with which he is affiliated. I take pleasure in introducing to you Mr. A. C. Bedford. (Applause.)

Mr. A. C. Bedford, Chairman of the Petroleum War Service Committee, then said:

President Guffey, and Gentlemen:

I will have to ask your indulgence for I do not know that I can make my voice carry. I have been suffering from laryngitis the last week, and until yesterday could only speak above a whisper. When President Guffey asked me to take charge here today, I am sure it will occur to all of you that he was not calling the right man. The man who should have taken charge of this part of our program is that very modest gentleman (we all highly esteem), who was recently appointed Chairman of the Production Committee of this District. I refer to Mr. George W. Crawford. (Applause.)

It is not my purpose to try to make an address to you, as you are anxious to hear the speaker of the afternoon, Mr. M. L. Requa. I only wish to say a few words, with reference to that part of our discussion today which we now turn to, namely, the oil question.

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In considering the oil question we have got to put aside all thoughts of peace and turn our minds to war! We have got to forget conditions as they have existed in the past and turn our thoughts and our attention, and our energies to the emergencies of the present. You gentlemen know, as well as I know, that the requirements for oil are such as to tax the facilities of our production to the utmost. It is therefore imperative that oil production should be encouraged and developed to the highest extent possible. To that patriotic end every oil producer should give his utmost endeavor.* That means that we have got to have, throughout the whole industry, the most efficient co-operation and co-ordination that it is possible for us to have. That means that we have got to do our business, perhaps, in a different way from that in which we did it before. It is impossible for us to go on, — in this business at least, — as in ordinary times. It is not a time when the conditions of the law of supply and demand shall govern, or the law of competition shall govern. It is a time, as I said a moment ago, for absolute co-operation, and that means not only the co-operation of the individual with the individual, but it means co-operation of the individual with the Government, and the co-operation of the Government with the individual. We have got to forget many things. We have got to forget that we are in business solely and mainly for profit and for profit alone. Profit has got to be a secondary consideration. We have got to forget that we are in business to build our business up to the greatest extent possible. This is all right, and perfectly proper in ordinary times, but these are not the times for one man to climb up or to extend his business at the expense of another. We have got to forget the old animosities and prejudices. In fact, paradoxical as it may sound, we have got to weld ourselves together as a whole, if we are to retain our business as individual entities.

Now, you know, probably all of you, so that it is not neces-

* The producer as well as the refiner, distributor and carrier, whether he has to distribute by pipe line or ship, must in a spirit of fine patriotism, consider also the conditions of the times and realize he cannot carry on his business as under normal conditions.

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sary for me to repeat it here, how the industry has tried to meet these conditions of which I have briefly spoken.

The organization which the petroleum industry has built up had its first inception, as you will recall, at the instance of the Council of National Defense, a Governmental body, which caused to be organized the Committee on Oils of the Advisory Council of the Council of National Defense, or Petroleum Committee, which became a trade committee, representative of the trade. When the Committees organized by the Council of National Defense were dissolved and the Petroleum Committee became, at the written request of the War Industries Board, the Council of National Defense and the Shipping Board, a committee representing the Petroleum Industry.

On the appointment of Mr. Requa as Administrator of the Oil Division of the Fuel Administration, the Committee got in touch with him, and I am delighted to say here in his presence, found in him a man of breadth of view, as well as strength of purpose, and with the broadest ideas as regards the duties of the industry and the duty of the Government. Mr. Requa gave a cordial reception to the idea of complete co-operation between the Government and the industry. At his suggestion the Committee was enlarged, as you know, and now numbers some thirty-four men, representative of all the various branches of the industry. Under its direction numerous advisory committees have been formed throughout the country. There have been formed two committees in this district, one on production, the chairman of which is Mr. Geo. W. Crawford, and one on Manufacturing and Distribution, of which Mr. S. Messer is Chairman. The National Committee, together with the various Advisory Committees, act at the suggestion of Mr. Requa, as the point of contact between the industry and the Government, and we ask all of you gentlemen today, for these committees and for the National Committee, on the part of every oil man, and also on the part of every gas man, — for the gas men are also interested in this, for there is a natural gas committee, of which your President, Mr. Guffey, is the Chairman, also affiliated with the National Petroleum War Service Committee, — we ask for each of these committees, and for the National Committee, the individual and

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active support of these industries. With your support, with your help, lined up behind these committees, there is nothing that the industry cannot do that is humanly possible, to meet the war conditions, and to provide, as has been done up to the present time, at least every gallon of oil that is necessary to fully supply our own Navy, our own Army, and the navies and armies of our Allies. (Applause.)

Now, the situation which, of course, comes home to every man is more or less personal. We wonder, under present conditions, where we are being led to, and the end will be. It is very simple to my mind, if the industry conducts itself as it should.

The broad principle which Mr. Requa has laid down is fundamentally correct, and one that the industry, as a whole, can be thankful for. Mr. Requa has said that he expects the industry to govern itself, and he construes that his duties are to help and assist the industry in those matters, where the industry cannot itself perform what is to be accomplished. without such assistance. Take, for example, the question of the delivery of fuel oil. With a shortage, such as existed during the winter, and as in all probability will exist again during the coming winter, the question of priority naturally comes up. A company with numerous contracts on its books could not determine for itself the priority of delivery, when it could not fill, through lack of supply, all its contract obligations. It could not discriminate among those with whom it had contractual relations without incurring penalties or possibly lawsuits for damages. Consequently the Government had to come in and say, "Such and such is the order of priority, and you must deliver the oil you have available in such and such order". Mr. Requa came to the rescue of the industry at this critical time and after consultation with the National Committee, issued certain priority orders.

Now, of course, which in general the proposition is that the industry shall govern itself, yet at the same time, we recognize the fact that the Government — and when I say the Government, I refer to Mr. Requa, for he is the man with whom you will have to deal as personifying the Government, — the Government must have the final say in all of these matters, and while it is not desired to exercise a drastic control, — and with proper care on the

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part of the industry, drastic control will not be necessary, — yet the industry must be conducted more or less under the direction of the Fuel Administration.

That brings us to consider the question which is paramount in many minds at present. The price question has agitated the industry considerably, especially that part of the industry concerning the production of oil. I think there has been some psychology applied with reference to the subject, as it has been working itself out in the minds of the producers, due at times to some uncertain features with reference to the industry which has caused much hesitancy, but I believe that these uncertain features have more ar less been cleared away. The atmosphere is clearer today than it was before. The principle has been announced that the small man must live, and must be allowed to live, and that fair profits would be permitted has been clearly established, and that because of the necessities of the case production of oil must be especially encouraged. But that does not mean for a moment anything more than a fair return, and fair prices. Not run away prices, and any one who takes advantage of the situation to exact undue and unlimited profits as occasions may offer, will certainly find that the stern hand of the Government will be found restraining him without mercy. As to the merits of such a principle, in these times, I think we all agree, for we are proud to feel that the industry, at least up to the present time, and with very few exceptional instances, has not been on what might be called a profiteering basis, but an earnest endeavor has prevailed throughout the industry to conduct its business conservatively, wisely, and with due consideration to the public, and to charge only fair and reasonable prices. Such advances as have been made have been due to the fact that production had to be stimulated, and in order to get the necessary crude oil, higher prices had to be paid because of many conditions with which you are all familiar, and that I do not need to go into.

Now, we welcome any investigation of the industry that shall demonstrate the fact whether we are profiteering or whether we are not.

Speaking for the National Petroleum Committee, I want to say that they wish to feel, and they wish Mr. Requa to feel, that

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the industry, as a whole, is absolutely sincere when it stands up and says to the public that it is going to carry on this industry with a pure spirit of patriotism and love of country. (Great Applause.)

Now, how can we get at it? The way has been devised. It is generally or tacitly understood, I think, with the Fuel Administration that prices throughout the country shall remain as they are. If, for any reason the industry, or any part of it, feels that prices should be advanced, it is expected and hoped that they will take it up through the proper Committee, who will study the question. If it is a local question, it will be passed on with the decision of the local Committee to the National Committee, who will, on its part consider it from the National standpoint.

Take for example the question of Pennsylvania crude oil production, a study would be made by the local committee in conference with the producers in this section. This committee would report to the National Petroleum Committee who in turn would consider the question in its relation to all the other producing fields, and the effect and conditions that would necessarily be involved. Thus a complete study would be made as to what effect any change recommended in price might have, and the united judgment of the industry would be passed on to Mr. Requa, who, in turn on his part will have his own men, such as Mr. O'Donnell here, who is in charge of the production department of the Oil Division, make their independent examination, and then we hope to be able to sit down and agree with the Government that such and such conditions warrant such and such changes. Thus the Government and the industry, working together, certainly are above any political or public critcism in reference to whatever step may be taken. (More applause.)

Now, we believe such is the proper course to pursue. At the present time an examination is being made along these lines with reference to export prices, and this is how it is being done. Mr. Requa has arranged with Sanderson and Porter, an eminent firm of engineers, to take the Federal Trade Commission costs, and to study them very carefully and very thoroughly, together with such other data as is available, with a view of determining what constitutes, if possible, a fair profit. The industry, through the

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National Petroleum Committee is represented in this conference by Messrs. Ford, Bacon and Davis, whom they have asked to act for the industry, and any refiner who is in any way affected by this proposition with reference to export oil, is invited to present facts, statistics, and data, together with any suggestions or thoughts he has to make, through Messrs. Ford, Bacon and Davis, so that they may take up with Mr. Requa's engineers, and consider all the facts both from the industries' point of view, and from the governmental standpoint. These findings are to be submitted to Mr. Requa for his consideration and final determination. By this method the industry is allowed to present most thoroughly and clearly its statement of the case, and what affects not only the industry as a whole, but also the individual refiner.

The same proceeding may be taken in other lines, and in other districts relative to local matters whenever it is necessary to do so, and by that method we believe that a very clear understanding will be had by all parties concerned.

This is not price fixing, Gentlemen. It is, as I construe it, an agreement on the part of the industry to work with the Government, to the end that fair prices as between the industry and the Government, our allies and the public, generally, shall prevail, throughout the period of the war. (Applause).

Now, I want to just say one other word, and then introduce to you Mr. Requa, who will address you at length. This has to do with the question of prices. I take this opportunity, because of the publicity that will be given to the statement, by its being made in this presence, and to get before you at once, the information therein referred to, to read a letter which I have just received from Mr. Requa, relative to crude oil prices.

This letter is dated Washington, D. C., May 17th, 1918, and is addressed to me as Chairman of the Petroleum War Service Committee. He says: "Dear Mr. Bedford: I have been informed that in certain localities there is a tendency on the part of oil producers to withhold production in anticipation of increased prices, either in the form of an increase in posted prices, or in the amount of bonus paid. I cannot too strongly emphasize the statement that the Government will not at this time view with approval any further advance in the price of

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crude oil. Because of the war and the demands that are being made for various essential products, it is obvious that the law of supply and demand has broken down. In many lines bidding up the price will not produce a single additional pound of material. Such price advances cannot be permitted by the Government, if we are to eliminate profiteering and maintain fair and reasonable prices. Will you therefore make it plain to the producers of oil, that the Oil Division believes there is no justification for an advance in the price of crude oil at this time, and will expect the industry to co-operate with the Oil Division in an endeavor to maintain existing prices as maximum prices. Competition in the form of the payment of bonuses should also be restrained." Now, note this carefully please: "I do not mean by this that varying prices should not be paid for oils of varying qualities, but this differential, once established, should not be further advanced. I shall be obliged if you will give full publicity to these views and take the matter up with the Advisory Committees on Production affiliated with your Committee, for full consideration and report."

I said, as you know, Gentlemen, on this very point, in speaking publicly at Chicago this, that it was inconceivable to me at this time — if the oil industry as a whole from producer to distributor recognized and understood the situation, and the critical condition of the industry, as related to the war, and to the matter of supply and demand, — that it was inconceivable that any man would now attempt to build up his business to the detriment of some other man.

Any man now who is running a certain amount of oil in his refinery cannot increase that amount, no matter how great the demand is on his refinery for production, unless he takes oil from somebody else. It goes without saying that he cannot get that oil from somebody else without paying a higher price. Now, the man that has the oil is not going to let it go, but he will offset that with another bid, and you will find yourselves in the situation of pyramiding your prices. Then, where are you going to stop? There would be nothing left to be done but for the Government to step in and say, "Enough, this has got to stop".

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MARK L. REQUA,
Director Oil Division,
United States Fuel Administration

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Now, Gentlemen, we have been warned in this matter. We know the conditions. I am sure we will all be patriotic enough to comply with these reasonable requirements. We will show no selfish interest in our earnest endeavor to do our bit. We will all see the absolute, prime necessity for it, and as I said before, we will govern ourselves accordingly, in a pure spirit of patriotism, and do that which is necessary, and I am sure you are with me in assuring Mr. Requa that that is our intention as an industry. (More applause).

Gentlemen, I now take pleasure in introducing to you Mr. Requa (long continued applause).

Hon. Mark L. Requa, Director of the Oil Division of the United States Fuel Administration, then said:

Mr. Chairman, Mr. Bedford, and Gentlemen:—

It is very difficult for the layman who does not come into intimate and close contact with affairs in Washington to realize fully not only the magnitude but the diversity of the problems that confront the Government in its dealings with the Petroleum Industry. I approach this particular problem somewhat disillusioned because of an apprenticeship served under Mr. Hoover, in the Food Administration. There was a time when I was quite confident that there were a great many non-essential industries in the United States, but now I am vainly looking for *one* industry of which it could be said, "it is non-essential."

In the distribution of oil under the priority classification I found the most unexpected obstacles in the way. A man in New England was manufacturing chain, and he was in priority class 12. Manufacturers of tractors for farmers were in class 9; and the man who was making the tractors came to me and said, "Unless we can buy some chain we cannot run the tractors; and if we don't run the tractors the farmer cannot plow, and if the farmer does not plow, there will not be any wheat"; and it became obvious that there must be some way discovered of supplying with fuel oil the man who made the chain.

A man in Florida was manufacturing Fuller's earth, and we found it necessary for the oil refiners to have Fuller's earth if they were to make proper lubricants; and so it goes almost

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without end. One part is dependent upon some other part; the various departments of the oil industry must supply their production efficiently and satisfactorily, or some other part of the Government program will fail. A man somewhere here in the vicinity of Pittsburgh, who is manufacturing rivets, ran out of fuel oil. I was advised by an investigator from the Shipping Board that the ship building program of the United States was in danger of slowing up unless the rivet manufacturer got oil. So if we are adequately to appreciate the existing conditions it can only be by means of a consolidated picture that will show in general outline the requirements of all the branches of the Government; and to meet that very situation there has been organized in Washington what is known as the Priorities Committee of the Council of National Defense. That committee grants priorities. Then there is the Requirements Committee which meets every morning and receives requests from the various departments for their requirements.

The Government in its program alone,—to say nothing of the industrial life of the nation,—can today consume practically the entire iron and steel output of this nation. It is obvious, therefore, that there must be come distribution of those supplies. Everybody may not receive all that they require, but everybody engaged in war industries will receive something.

The oil problem to a very large extent is primarily a problem of transportation. Because of the requirement for ships to carry oil to Europe, a great many tankers upon the Atlantic Seaboard have been diverted to Trans-Atlantic Service. Adequately to meet that situation has required practically the consolidation of the oil industry of the nation.

The managers of all the large selling organizations are meeting regularly in New York. The cards are all on the table, face up; there are no secrets; every man knows the ability of everybody else to deliver; and where there is a shortage, someone steps in and helps supply the deficiency. There is no other possible conduct that would adequately meet the situation, and there is absolutely no excuse for failure to carry out a program of that character.

Such action among the oil companies themselves is obviously impossible without the assistance and protection of the

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Government of the United States. That protection the Oil Division is giving. It involves the complete temporary abrogation of the Sherman law.

The oil industry today is acting as a unit under the direction of the Government, not only upon the Atlantic Seaboard but upon the Pacific Coast as well. Upon the Pacific, pipe lines have been unified; one pipe line has been closed down; oil produced in the San Joaquin Valley has been exchanged for other oil produced in Southern California, to the very great benefit of the public at large; these actions have made possible and are serving the communities upon the Pacific Coast in a way that they could not possibly otherwise have been served. I think that many of us do not realize that the oil industry of the world today, so far as the Allied nations are concerned, centers in the United States. By a very great majority the oil that is supplied to England, France and Italy, comes from America. The export of oil has grown by leaps and bounds, and I presume will continue to grow during the present year quite as rapidly as during the past year or two years. So we have not alone the question of the supply for the Allied Governments for their greater needs, but we have as well the question of the supply of the industrial population; and it is obvious that if we are intelligently to consider that condition we must know what those demands are to be and what are to be the demands of our own Government for military purposes and for the use of our own people.

We are engaged at the present time in attempting to consolidate the various estimates with a view of placing upon a single sheet the total requirements that will be needed and to offset against them the total possible amount that can be furnished by the United States; and I have had, at all times, a profound conviction that somehow, some way, the oil industry of the United States would make good one hundred percent. (Applause.)

Our problem, speaking from the Government standpoint, is purely a problem of assisting the oil industry in doing as a consolidated unit those things that cannot be done by the companies acting separately, no matter how powerful they may be as private institutions. We have to consider the supplies of gaso-

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line not only for ordinary purposes but for the purposes of aviation. We have the German specifications; we know what the Germans are furnishing to their flying machines; we know what France is furnishing to her flying men; we know what Great Britain is furnishing to her fighters; we know that there is just one kind of aviation gasoline that should be furnished to the American soldier who risks his life in an airplane, and that is the very best quality that can be made. (Long continued applause.) It makes absolutely no difference what the sacrifice may be in the manufacture of that material. If it is found necessary to suspend the operation of every pleasure automobile in order to utilize the gasoline for the manufacture of aviation spirit, I know that the American people will cheerfully walk. (Applause.) It needs but the demonstration of those facts, clearly stated and conclusively proved, to have the entire nation behind whatever action is taken; and no action should be taken until that investigation has been thorough; until we have gone to the botton of the problem, until we know everything that is to be known about it.

The question of aviation gasoline is now being considered in Washington by the men best equipped because of their scientific knowledge to answer conclusively and finally the question. The Bureau of Standards in conjunction with the Bureau of Mines, is conducting extensive tests; and when those tests are finished, when those conclusions have been ratified by the Government officials and by the experts from the industry, I believe that a very definite statement can be given and a very definite reason can be given for the specifications that may be put out for aviation gasoline. I do not pretend to say at the moment what those final specifications may be; but whatever they are, whatever is necessary to give to our men who risk their lives in the defense of liberty not only in Europe, but in America, — whatever the specifications are, they will give to those men the best product that can be made. I am confident that the oil industry will respond cheerfully and will gladly supply that product. (More applause).

The same thing applies in lubricating oils. A study is being carefully made to determine whether something better can be provided than is already being used. The best is none too

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good. Anything less than the best will not be countenanced, not only by the Government but by the oil industry which is supplying that product.

There is just one way that the Oil Division of the Federal Administration can succeed, and that way is through co-operating with the oil industry and giving the oil industry whatever assistance is necessary to help them govern themselves wisely and well during this crisis.

Nothing else matters, today, save the winning of this war. What we have will be of little value to us if we do not win. Everything that we have believed in; everything that we have fought for; every tradition of human liberty for which our ancestors risked their lives, is at stake, today; and I believe that a free people, fighting in defense of those things can and will do, voluntarily, every act that is made mandatory by the autocracy of the German Empire. (Great applause).

I am not so foolish as to believe that I can run the Oil Industry of the United States, but I *do* believe that I have a part to play and I *do* believe that under the Lever Bill, it is possible, with the authority vested in the Fuel Administration, to make more efficient the service of the Oil Industry to this Government in the time of its greatest need.

Few people realize how far-reaching are the powers delegated under that bill. I may say to you that in the first conference I attended in New York City with the Petroleum War Service Committee the provisions of the Lever Bill were discussed by the attorneys representing the oil industry; and after an all day session, participated in by the ablest legal minds I presume in the City of New York, the agreement was unanimously reached that under the License Section rules and regulations would be promulgated that would make it possible for the Fuel Administration practically to dictate to the Oil Industry how it should conduct itself. I am not unmindful of the power for evil in the exercise of that authority, unwisely. I believe, because of the tremendous authority conveyed, that it should be used sparingly, and in an endeavor to assist the industry in helping itself. (More applause).

The subject of licensing was taken up recently with a committee representing the jobbers of oil. They came to New York;

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we had an extended conference; we went into all of the ramifications and angles of the problem; we spent all day on it, and I suspect they spent a portion of the night upon it. At any rate, coming there as they did, convinced that the jobbing industry did not need regulation, that they did not need licensing, they came the following day and said, "We have considered this subject, and find but one adequate answer. We make the request of the Fuel Administration that the oil jobbing industry of the United States be placed under license." That was an experience profoundly gratifying to me. I felt that a very great majority of the jobbers of oil did not need any regulation, but in all lines there is always a minority which no matter what the occasion may be will take advantage of it to the detriment of their more conscientious associates; and I could see no way to control that element save by licensing, so I said to the jobbers that that element would be controlled.

Under the licensing provision, rules and regulations may be promulgated of the most drastic character. The provisions are identical with those being utilized by the Food Administration in the licensing program; and you may have noticed, from time to time, that licenses have been revoked and men have been prohibited from doing business; and I want to say, with all the emphasis that I can exert, that, in the oil industry, if there be men of that character who are willing to take advantage of the times, whose consciences are so degraded that they propose to fatten upon the blood and bone of the American people, then so far as I am concerned, the first mistake, the first misstep, will be the last and for the period of the war they can rusticate in idleness. They cannot do business in competition with honest-minded American Citizens who recognize that their first duty is to their country, their second duty to themselves. (Long continued applause).

I consider it a great privilege to come among you gentlemen here today and to tell you some of the problems we have to deal with in Washington; how we are confronted with an acute shortage of oil in California; how we find it practically an impossibility to convert the oil burning industries of the Pacific Northwest to coal; materials for that conversion are

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lacking; they cannot at this time lay up the ships to make the conversion from oil to coal burners; they dare not lay up the locomotives to convert them to coal burners. The Pacific Northwest, under existing conditions, cannot produce sufficient coal to supplant the quantity of oil now being consumed. We have nitrate fields in Chili to supply with oil. The Canal at Panama must be kept supplied. The domestic industries of the United States must be cared for so that the necessary supplies may be manufactured for export over-seas, and the needs of our Allies must be of paramount importance to us in our calculation. The demands of our own force in Europe are constantly increasing, and I believe that they will increase for a considerable period of time to come.

My own impression is that this war will be won in the air with gasoline supplied by the oil men of the United States; and I can conceive no prouder distinction than to be entrusted with the responsibility, as you men are, of supplying that product.

The men who produce the natural gas of the United States have quite as great a responsibility resting upon them. There is gasoline made from that product that can be utilized to great advantage. Natural gas can be supplied in places where it will release either coal or petroleum, and to those of you who are engaged in the natural gas industry I can but say that it is your duty, so far as you can, to keep your production at the maximum. The conditions that will confront us next winter will in all probability be as acute as those that confronted us last winter.

There is a congested portion in the eastern portion of the United States east of Pittsburgh in which it seems almost impossible to meet adequately the demand that will be made for fuel.

Efforts are being made to convert coal burning plants to fuel oil. We are asked to supply the fuel oil and to give transportation facilities. I know that the oil can be supplied, but it does not seem humanly possible that transportation facilities will be adequate to meet all the demands that may be made upon it during the coming winter.

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This is a time, gentlemen, when individualism must be submerged. The effort of the individual must be consolidated into the effort of the Government during the period of the war. The greatness and the glory of this nation has been founded upon indivdual effort, but the test of democracy, — the greatest test, I believe, that democracy can undergo is gladly and voluntarily to surrender that right of individual effort in the time of crisis and act as a unit under Government control for the best interests of the nation as a whole.

Mr. Bedford read to you a letter I wrote him a few days ago on the subject of the price of oil. I may say to you that the question of price is undergoing most careful scrutiny. We have received at various times figures of the Federal Trade Commission indicating costs of performing various operations. Those figures we are assuming as a basis. We are reviewing them and examining them with the object of determining what should be right and reasonable and just prices at which various petroleum products will be sold; and in that examination the oil industry through the Petroleum War Service Committee is co-operating most heartily, most willingly, in an endeavor to assist us in determining the facts.

Industry of any character is entitled to and should receive just compensations for its effort; and that compensation should be based upon the character of the industry, upon the hazard, and upon the vicissitudes connected with it. I do not want you to think that there is any effort upon the part of the Government to interfere with normal channels of business more than is absolutely necessary under the conditions that exist at the present time. Action of unwise character is far worse than no action; but we are concerned with conditions today that are entirely new and strange. The normal atmosphere of business operations has given way to the abnormal atmosphere of war; and we must govern ourselves so as to make most efficient the petroleum industry for the winning of the war. I am proud to say that it is my profound belief that when the history of these times is written it will be found that the petroleum industry and the gas industry have played their parts

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as well, as efficiently and as patriotically as any industry within the United States. (Applause).

CHAIRMAN BEDFORD: Gentlemen, I am sure that after this lucid and illuminating talk by Mr. Requa, there is a feeling amongst all of you, possibly of relief, but at any rate of confidence in the future, of your industry. I think I can say again, and you will believe me now as I say it, that the industry is to be congratulated that a man of Mr. Requa's breadth of vision is in charge in Washington today of our oil industry. These matters that he has spoken of must make clear to you that, which has been so very clear for twelve months to those of us who have been discussing the vital matters concerning this industry, that the paramount thing in our hearts must be the carrying on of the war, and we must submerge everything else to that one end. I could tell you of sacrifice after sacrifice, of loss of money, of loss of ships, of loss of human lives that have been contributed, sustained by oil men and oil companies. It is little that is asked of the producer, in comparison with the great problems with which we are confronted, to ask him to go out and to produce all he can. It is only right that he should bear his share of the burden; that he should do his share and his part, and I know that he wants to do it.

If you wanted to know what is being done, I wish I could sit down and have the same intimate talks with you that I have had with some of the gentlemen present in this room, as to existing conditions, and as to the problems we are forced to face, and we are face to face with every day. But there are men here who can tell you as to those conditions, and who will verify Mr. Requa's statement that everything is put upon the table face up; that there are no secrets. That there are no preferences; that everybody is seeking to treat everybody else alike. I refer to Mr. Messner, Mr. Barr, Mr. Dawes, Mr. Doherty, Mr. Guffey, Mr. J. C. Darnell, and Mr. George W. Crawford. I think all of these men are here today, together with some other men who are meeting every week to consider the great problem, representing as they do, with other men whose names I do not need to give you, as you know them all, this great industry which is to play such an important part in the world war.

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I think I can assure Mr. Requa, today, in your name, that every man in this industry is with him in the prosecution of this great work. (Applause.)

Not the least good sense that Mr. Requa has shown has been the selection of some of his assistants. We are fortunate in having with us today, Mr. O'Donnell. We did not expect he would be here, but he is like the man who says he could not do something, and then goes ahead and does it, and I know we all like him better than the man who says he will, and then don't, for Mr. O'Donnell telegraphed me yesterday he would not be able to come, and then he telegraphed Mr. Crawford that he would be here. He is here now, and I have great pleasure in introducing to you Mr. O'Donnell, who is in charge of the Production Division, under Mr. Requa. (Applause.)

Mr. T. A. O'Donnell, Chairman of the Oil Production Division of the United States Fuel Administration, then said:

Mr. Chairman, and Gentlemen of this Convention:

I will not have talked very long before you will know that my appointment on the Oil Division is not on the basis of my oratory (laughter and applause). I am what they now call — they have given me two or three different names since I have had this Government job, but they now call me Director of Production.

Out in California, where I spent the greater part of my life, they call a certain class of field workers, "rough necks". You fellows here call them B. S.'s, or something of that kind (more laughter and applause). Well, I have been one of them. I sold newspapers on the streets of Bradford, forty years ago, and I have been twenty-eight years actively engaged in the production of oil in California. I am unable to come before you, because I have lacked the opportunity of a refined education, and tell you about the origin of petroleum, or why it is, or what relationship it may have borne to ancient Greek history, if they had it then. Dr. White, whom you all love, and whom I count among my friends, furnishes me frequently with the long names, if I have any use for them in the way of geological terms.

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I have been educated, though, Gentlemen, in the university of adversity and experience. I am going to talk to the producers today. I can talk to them, and they can usually understand me. A good many of them have been "rough necks" themselves (more laughter and applause).

I have been a little apprehensive, sitting here and listening to the able gentlemen who have preceded me. I do not know whether it is nervousness, or the climate that has melted my collar. I am sweating (continued laughter and applause).

I want to talk today to the producers of America, to the oil producers, who, in my judgment, are equal to any class of like number of men in the world (more applause). In my judgment they are a class of men who are going to do their full duty in connection with the world crisis that now confronts us.

I went to New York early in January, but had no more idea that I was going to accept a Government job than any of you who are present here today. I learned of the appointment of Mr. Requa as Oil Director, or as Director, of the Oil Division, while in California. I have known Mr. Requa for a number of years. He is my friend, and my associate in business. Still, I was apprehensive. I felt, as many business men of this country no doubt have felt in connection with Government supervision, that Governmental control would have its obstacles. I was rather proud that the industry was conducting itself, as it would seem to me, along conservative lines, and so, filling the National requirements of Government regulation. I was apprehensive, as the producers throughout the country were apprehensive, that public opinion, and public demand might bring about an effort in Washington to take charge of the oil business of this country, and to put it into the hands of a lot of accountants, whom I am apprehensive about also (more applause and laughter). I doubted the necessity.

When Mr. Requa asked me to come and assist him, and take charge of the oil production of the country, I felt that my health would not permit me to undertake the effort, and then I thought of my relationship to him, and the real knowledge that I have of producing conditions in this country, and Mexico, and because

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of his confidence in me, I felt that probably I could be of assistance to him in an advisory capacity.

This war demands of us,—you and I,—no consideration save national welfare, whether the thing involved is our fortune or our lives, and no man has a right, as a good citizen, at this time, with conscientious thought of his Government, to shirk any duty that is put up to him, that he, with a clear conscience concludes he can perform and perform well (more applause).

I want to say to the producers here today—I am not as sure about the gas fellows, for I don't know them as well, but I know I can talk to the producers, and my conclusions about gas men are that they are not any different, for they are the drillers of wells, and the same problems confront them that confront the oil producers, and I want to say that in so far as my work is concerned, I have a full appreciation of the difficulties of an oil operator. I have been very active, as those who know me, from California will tell you, in that state, and in Mexico, and I have met all the problems that we have to meet through rather a long life of activity. If my judgment prevails,—and I believe it will as long as Mr. Requa holds his present position, because he thinks along the same lines,—the oil industry of the United States, in so far as the abstract problem of producing oil is concerned, is in no danger in our hands (long continued applause). We know your problems. We know that from ninety to ninety-five per cent of all wild cat wells drilled in the United States, were failures, and from five to ten per cent have been a success, and that this has been the foundation upon which the oil producer has built the great oil industry in this country. We know the spirit that is necessary to prompt individuals to go out and explore. We know the constant necessities of the business, and the margins that are required for the successful conduct of the business, in order to meet the constant vicissitudes which are encountered. We also know, Gentlemen, enough about it to know when your industry is in a healthy condition. If we had any other object in our official capacity than the National welfare, and if we deal with prices with any other object than to produce for this country and our Allies, the necessary petroleum, then we ought to be shot. We are accepting the responsibility

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of looking after the petroleum supply of this country, in so far as any Government interference is necessary, and in doing that we are going to do the right thing by you, because it is necessary to do the right thing by you for the National welfare. The machine for producing oil has got to be in a healthy condition.

I am not an expert in examining balance sheets, or auditors' reports. I defy any set of auditors in the United States to produce the figures which will show what a barrel of petroleum costs in the aggregate in this country (long continued applause). It is an abstract problem. It takes an optimist to pursue the game (more applause and laughter), but we have got to be supplied with the wherewith.

On the other hand I take my hat off to no man in the United States when it comes to analyzing whether or not the industry in a particular part of the country is in a healthy condition, or not, and whether it needs extra stimulants.

Now, you are going to perform in this country one of the great needs in this terrible struggle we are in, and you are going to do it voluntarily, and you are going to do it with contentment and assurance, and you are going to believe it when we say to you now, after a complete survey of the entire American continent, in your oil producing areas, that we believe that the oil producing part of the nation is in a healthy condition, under present prices, and it should and will get the necessary quantity of oil where and when it is needed.

We believe, in connection with our work at Washington, — indeed we are convinced, that the time is here when it is absolutely necessary for the petroleum industry, as well as many other industries in this country, to be in a stabilized condition.

We believe in that wonderful steel industry that is so important to us in this great struggle, that they have reached a stabilizing period, plenty of margin, it is true, to leave the industry in a healthy shape, but we believe it is stabilized, and we believe the oil producers of this country can and will produce the oil necessary for the National need on the present basis of cost, and I wish to assure you that we are giving that careful consideration, and we wish at all times to be informed properly and accurately of any change of condition. I personally

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believe we have reached the apex of increase of price of the things you use, and knowing what it costs to produce oil, we believe that you can, under present conditions, produce that oil and leave yourselves in a healthy condition. Therefore until we know of some other things having a bearing upon your industry in such a way that it is going to produce an effect on the industry itself, indicating that it will not furnish the petroleum required, then we are going to ask you to let us help you stabilize the product where it should be stabilized in order to produce the necessary quantity and quality, and we want to assure you, or do at least after a complete survey, of the United States, that it is our earnest desire to assist you in every way we can to meet the demands that will be made upon the industry in order to assure the successful prosecution of the war.

I have probably met more producers of oil in the last few months than any one man met before, and I have not failed, in any instance, to get the heartiest support for the sentiments I have just expressed. (Loud applause).

I come from a state, Gentlemen, where I have spent my life, and where the price of crude oil is the lowest that it is anywhere in the United States, and where it costs the most to drill a well. I was amused at a statement Dr. White made to you in referring to a well that he spoke about in the course of his paper, in which he said that that well might have cost $50,000. Our average cost in California at the present time is about that figure. We frequently get $100,000 into a well, but of course, they are good wells, and they last a long time. (More applause and laughter).

MR. BEDFORD: Some of them are dry holes.

MR. O'DONNELL: Yes, some of them prove to be dry holes. The California producer might say to us, and has said to us, "Why is it that the oil down on the Gulf Coast that is used for the same purpose that the other fellow's oil is used for, and is of the same character, sells for $1.80, and we only get $1.23 per barrel for it? In fairness to us, having the same kind of a product, we should get better prices."

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Gentlemen, if you will sit down with your conscience, your God and your country, you will know that is not the right basis of argument, in this world crisis. Because you happen to be in that part of the country where God Almighty was more liberal in the distribution of his wealth, is no reason why in this particular time of the Nation's want, you should seek to enrich yourselves because some other fellow gets a better price in some other part of the country. I have had it put up to me in my travels throughout the country about the four dollar oil in Pennsylvania, and I have said to some of these fellows, "You don't know what you are talking about. $4.00 is necessary in Pennsylvania, for they have to gather it with a tin can (more laughter and continued applause), and the operators in California and Oklahoma, and some of the other wild parts of the west, lose more money rolling in the grass than would absorb the profits of some of the little farms in the East. (More laughter and applause).

But you are, nevertheless in a healthy condition. I am here to tell you that, and you are here to acknowledge it with me, and then you are here to say that we are all going to do the right thing at this time.

Now, I want to tell you something about the problems we have got. We have got to furnish the oil to fill the gap in the struggle in Europe, during the next year or two. We are drawing on our stocks all over the country heavily. We drew twenty million barrels last year, and some estimates furnished by Mr. Bedford and others of the War Service Boards of this country, lead us to believe that we might, as a maximum requirement, have to draw eighty million barrels more from our stock in this country.

I believe the gas producers are going to have the necessary pep to do their part.

In the Western country, where we produce in large quantities, it may not reach those figures. It will reach them if we do not have the right kind of spirit among the oil producers, and all of us seek to do our part.

We have a safety valve in Mexico, that is going to take care of us in time, but in the meantime we have got to furnish

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every barrel of oil where it is, and when and how it may be required, and we must furnish it at the time that it is needed. The time it is needed is now, while we are building ships to take care of ourselves in the future, and anybody in the oil industry in this country that is withholding their oil from the market, with the hope of a future price, that will justify them from a business standpoint in holding that oil, if he will sit down with a clear conscience and think it over, he will know that by so doing he is lowering his standard of citizenship. (Applause).

Gentlemen, that is something I want you to think about. We need it now. We need the oil that you gentlemen are producing here in the mid continent field, to fill the gap — for what? To drive from the earth the damnable Germans. (More applause).

You know, Gentlemen, some of us are nearing the latter part of the trail of life, but we always cling to it to the last moment as a precious thing, but I want to stand here and tell you today, with all the force that is in me, that there are two conditions under which I do not care to live from now on, and one is that this country might be dominated by the German spirit, and the other is by the Bolsheviki. (Long continued applause).

That does not only apply to myself. I have got a couple of daughters in their young womanhood, that I think more of than I do of all the money that any of you men have piled up, and I would not trade them for all of your money, too. I say to you here and now that I want them to die with me if Germany is going to rule the world. (More applause).

I take this matter seriously. I think it is very serious. I went to Washington believing, as I did, that we were not badly needed, but soon learning that it was an absolute necessity for the petroleum industry of this country to be co-related to the other departments of the Government in this great struggle. The first two months of my work in Washington was the most depressing period of my whole life. I didn't care for the business feature, or anything else. I was apprehensive of where we were going to. The endless confusion was amazing to a fellow like me, that had been having a little circle of vision, and not realizing the

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small margin of a great industrial nation, and finding in Washington the unsettled condition, or lack of centralized authority and responsibility that existed there, I was filled with apprehension. Men of talent were called from all parts of the nation, and had volunteered their services and had rushed to Washington into confusion and lack of authority and centralized responsibility.

I am glad to say I feel better about it now. I feel we are getting our feet on the ground, and we are going to face the enemy in the right spirit, with the right men at the head of our industrial needs. (Continued applause.)

I am not going to criticise. Far be it from me to criticise any part of our administration, and above all, our wonderful President. I am going to say to you, though, that I believe we have wasted a year in order to bring home to the American people the fact we were at war, and we had to educate them to produce the machinery that was necessary to win. We were a peaceful, reckless people. We were tearing apart instead of building up, for the last twenty years, our industrial machinery in the country, which might have been a good thing then. I am not here to contradict it in times of peace, but it was certainly not the thing to do as we were approaching war. We have to put those machines together in the way that the biggest and strongest men in this country have wanted to put them together in times of peace. We have to put them together as a War necessity. I do not believe the American people were ready for it when we first attacked this job. I do not believe that the American people would have felt the relief they did a year ago in the appointment of Charlie Schwab at the head of the Shipping Board. They would not have felt the relief that they did when that appointment was made. (More applause.) They would have criticised.

John D. Ryan taking charge of our aviation program is almost unheard of, if you will think of the attacks of the newspapers of the country upon that man in the past, yet the people accepted the appointment with assurance and good will.

The corporations of America were putting their talented men into our War Department. I think it is coming at the right time. I doubt whether the President, or anybody else, could have hurried it along. The American people are willing to accept it, and

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I thank God for it. (More applause.) Now, we have got our feet on the ground. We are going to start now, and we are going to start to fight, and when we get to fighting, believe me, we are going to go some. (Long continued applause and laughter.)

This is an industrial war. The industrial capacity of this nation is going to be measured by its weakest link, and there is no link in that chain of industries that is of any greater importance than that link which you gentlemen have got to weld and to watch. You know we are going to fight; we are going to fight everything in sight. (More applause.) And that means you. It means you. (More applause.)

There is a feeling among many people that Uncle Sam is at Washington. He is not there. He is a good deal like the God that many of us worship, or think about, at least. He is invisible. He is everywhere. He is right here today. He is here in this city. He is right among you now, and to serve Uncle Sam is just as much your duty as it is mine.

Notwithstanding I have accepted an official job that does not put any greater responsibility upon me than it does upon you, you must attack everything within your sight that needs attacking. That is the right spirit of Americanism, and above all, you must attack that damnable thing that is going throughout the Nation, the German propaganda (long continued applause), but in attacking that, spread a propaganda of your own, an American propaganda (more applause), and that brings home to me something I am rather embarrassed in saying in front of Mr. Bedford and Mr. Teagle here, today, but I want to say to you producers, so that you can stamp the poisonous snake that is issuing poisonous rumors to the country whenever it comes within your vision.

You know — whether justified or not, is not the point at this time, — that the whole people of this Nation will not get a square deal from public opinion without great effort on their part. It is a popular thing to attack. It is a thing for politicians to roll around their tongue. It is as poisonous, no matter if issued by politicians, or hawked about the streets, or in our town halls, as if it was paid for by the Germans.

I want you with me here today, to forget yesterday for today and tomorrow, and act accordingly, and in that connection,

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you are going to meet with rumors in connection with Mr. Requa and myself. I have been for twenty-eight years an active developer and producer, a field man in California, a place where twenty-five per cent of all the petroleum produced in the world was produced for a number of years. In my entire career I have never played in the front yard or the back yard, directly or indirectly, with the Standard Oil Company. I joined all the independent wild schemes that were ever promoted on the Pacific Coast. (More laughter and applause.) I was for ten years on the Executive Board of the Independent Oil Producers of California, one of the most active competitors of the Standard Oil Company that ever existed in the United States as an organization of that kind. I am telling you this, Gentlemen, so you can defend Mr. Requa and myself when somebody says that "I have seen Tom O'Donnell going up the stairs at 26 Broadway, and something is wrong." (Prolonged laughter and applause).

I am going up the stairs at 26 Broadway. In fact, I will tell you — there is no secret, — I have been there already (more laughter and applause), and I am going up those stairs as many times and as frequently as my duty calls me there.

I am going to go anywhere in the United States where I think there is a hidden German, and drag him out, if I can. (Long continued applause and laughter.)

Don't take me too literally, Gentlemen, for I can say, from personal knowledge, that there are no hidden Germans to be found at 26 Broadway, and I am going to wind up the subject of the Standard Oil Company for no reason but a wholesome one, by saying to all of you, that every person that I have met and been with, and worked with, which has included nearly all of the Standard Oil boys, within the last four months, has shown that degree of patriotism and sacrifice that would lead me to say that the Germans better go back to Berlin quick if all of the American people attack this problem with the same spirit that every single one of these men are attacking it. (More laughter.) I never saw a more complete spirit of sacrifice than I have met in that office. I at no time every heard anything that led me to believe that any but the utmost loyal American spirit prevailed

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and above all they are American through and through, and whatever they have is on the table for Uncle Sam to take if he needs it.

Their lives are in this work just as wholly and completely as any man in this room, and that is the thing that I want you gentlemen to help spread. But whenever you see that poisonous stuff cropping out, stamp on it like you would throttle the man who talks in favor of the Kaiser, because he is talking in favor of the Kaiser when he wants to bring up old prejudices at a time like this.

We had a recent experience down in Washington where a very important committee was listening to our land troubles in the West, the most important thing we had in connection with our petroleum industry in the west, where thoughtlessly or with malicious purpose—I do not know which—but I think thoughtlessly into that investigation was injected the words "Standard Oil." It was suggested that the Standard Oil might be interested in those lands, and they immediately forgot what they were there about, and spent weeks trying to find out if the Standard Oil Company owned any of it, and if they did, that was enough. It was wrong. That is the popular thing politically to say and do. Now, we want to stop that. We want to stop all kinds of wrong propaganda. That is going to be stopped, not by me talking about it here, or at a few town halls throughout the country, but by you gentlemen,—by every one of you, and I think every one of you that has got the thought in his mind to express that kind of a sentiment at this time, and to keep live the old prejudices until the war is over is not in favor of this family of ours, but he is doing his country a great injury and his family a greater injury.

A good many years ago, when I was a boy and first went West, I washed dishes in a restaurant. It was a rough community, a rough people, and a cheap restaurant. (Laughter and applause.) In those cheap restaurants they have rather heavy side dishes. There were two cooks, a man and his wife, and some dispute occurred between the man and the wife, and he hit her with a frying pan. I had this dish in my hand and I made a good shot at his head, and it was effective. But when I got

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out of that kitchen, I was a fit subject for the hospital, and the woman done the most of the damage. (Long continued laughter and great applause.) I tell you, Gentlemen, that same family spirit is something we are going to show here in this war. (More applause.) You are going to do it. You are going to help everywhere. And I want you to go home—you producers who believe in me and believe in our work, I want you to go home and everyone of you work to win the war. That is the business of the hour. Don't knock at home. Don't knock on the street. If you have to knock, come down to Washington and knock yourselves hard as you want to at our doors, and we will listen to you. (More applause.) We want your help. We have got to have it. We are not "super" men. There are none of them except in Germany. We are going to fail, unless we get united support of the oil industry of this country. We need your talent; we want you to point out to us when we are going along a path that some of you may feel to be wrong—point it out to us, why you think we are wrong. Come there as often as you want. Come freely. We are not thin-skinned. We don't want to run for office after this is all over either. (More laughter and applause.) We will stand by any criticism that is given in the right spirit. When you see us going wrong, say so.

I want to say just a word—Mr. Bedford, I don't know how long I have been talking, but too long I know, but I want to say just a word in conclusion on the labor question. You know that is a problem in which we are all interested very much. I simply want to say this, get out and talk to your men. Encourage them. Pay them what they are entitled to. But don't allow the wrong kind of a fellow to talk to them. There has been in this country too much rattle brained loose talk to the labor element of the country. Some of our labor union leaders are able, conscientious and loyal citizens of this country. Others are not. You must go among your men and instill into them yourselves the spirit that this is the time to do. It is no time to get hours and do less work. Stir up a loyal patriotic spirit among the men engaged in your industry. You fellows have got to do it yourselves. You have got to talk the fellow down that is talking to them about German propaganda.

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I want to close by saying that I consider this war a serious matter. I consider your part in it a serious matter, and I do not want you, any of you, today to think of joining or consenting to a "sauer-kraut" peace. (Great laughter and prolonged applause.) The German will have in his left hand the pen with which to sign it; with his right hand behind his back full of cheese, and he will ram it in your nose, and say, "You have got to like the odor." (Long continued applause and great laughter.)

CHAIRMAN BEDFORD: I am sure we all appreciate the talk of Mr. O'Donnell. He talks a language we can all understand. We know when he talks that a man is talking to us. (Applause.) Time is going along, but we have a few moments left. I should like very much if one or possibly more of the members of the advisory committees on production who may happen to be here would say a word. I will ask Mr. Phillips, Vice-chairman Advisory Committee Appalachian Production, Eastern Division, to say a word.

MR. PHILLIPS:. Mr. Chairman and Gentlemen Representing the Oil and Gas Industry: We meet here first as patriotic citizens; second, as business men; and third, as producers of oil and natural gas.

As patriotic American citizens everything that we have that is worth having; everything that the generations that are following us might have that is worth having, is involved in this war. As business men, we are reasonable men. Were that not the case, we would long since have been eliminated from the business. As producers of oil and natural gas, we realize that we are engaged in an industry that is absolutely vital, absolutely essential to the Government.

Now, the Government has appointed advisory committees in various sections of the country. I take it that these committees are for the purpose of eliminating, as far as possible, a great deal of suggestion and comment and criticism which would prove of no particular benefit in this crisis, and to make an accurate presentation of the petroleum and natural gas situation in these various districts so as to assist the Government in every way we can to help win the war.

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We have a committee known as the advisory committee, Appalachian production, with its headquarters in this city, and that committee, regardless of how busy the men are who are connected with it, are always glad to take up any suggestions, and to answer any questions that may be propounded. In fact it acts as a clearing house, so to speak, in the way of gathering facts and data and information needed at headquarters, and then forward what they think of value on to Washington.

The oil industry for years and years has been running with as little friction and as smoothly as possible, and it is our duty during the balance of the war to see that the oil and gas men run their own business without any internal friction in their business at all.

As far as the advisory committee is concerned, I know I speak for them, and I believe I voice the sentiment of all the people connected with the industry when I assure the people at Washington—Mr. Requa and his co-workers—that we will do everything within reason—more—we will do everything within reach in order to help carry out the suggestions that they may have to make. (Applause.)

CHAIRMAN BEDFORD: Is Mr. J. C. Darnell in the room? I would like to have a word from him. Mr. Darnell is chairman of the Advisory Committee, Appalachian Production, Western Division. I see Mr. Darnell at the back of the room. Come forward, Mr. Darnell, if you please. Mr. Darnell has some difficulty getting through the front line trenches. (Laughter.) Gentlemen, will you listen to Mr. Darnell just a moment.

MR. J. C. DARNELL: Mr. Chairmen and Gentlemen: I am quite surprised that the Chairman called on me to make any remarks here this afternoon. I did not know that I was going to be called upon. Furthermore I am not a public speaker, and after listening to the gentlemen who have just spoken, it seems quite embarrassing for me to undertake to say anything. I do not propose to make a speech or go into any details.

I am chairman of the Western Division of Appalachian Production, consisting of the western part of Ohio, Illinois, Indiana and Michigan. They are old fields. Ohio is very old. And there is no chance to drill any big wells any more. We do drill some

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wells, and, of course, by so doing, we keep up the production fairly well. But we are producing from wells that are averaging less than a half barrel per day.

Now, I have heard a good deal said about fixing the price to suit the well that produces a half or a quarter of a barrel of oil per day. That is impossible. You cannot fix a price for oil that will make it profitable to produce oil from that kind of wells. But we are keeping alive everything that we possibly can. Very many of the wells in our country are being run at a loss. That is to say, where there might be a good many wells connected together, two or three of the wells might be doing practically all of the work, and the others, of course, doing nothing scarcely. It brings down the average. But we are doing the best we can, and we will continue to do all we can to keep the production up and to increase it if possible.

We had a meeting of our committee in Toledo on the 13th of this month, and we took a solemn vow there (and the gentlemen were all enthusiastic) and said that we would do all that we possibly could to uphold the administration and Mr. Requa and Mr. Bedford, and I think that that is about all I could say in reference to the matter. Our hearts are in the work, and we will do everything we possibly can to assist in getting the oil which is now needed for the Government in this great work of winning the war. (Applause.)

PRESIDENT GUFFEY: Gentlemen, I would like to make a brief annauncement, that the annual banquet will be held promptly at 6:45 this evening in the ball room of the William Penn Hotel. Mr. Way and Mr. Adams will see that every one who wants tickets is supplied.

And thereupon, on motion duly seconded and carried, the Association adjourned to meet at 10:00 o'clock A. M., Thursday, May 23rd, 1918.

SECOND DAY — MORNING SESSION.

THURSDAY, MAY 23RD, 1918.

PRESIDENT GUFFEY: The meeting will please come to order. It gives me pleasure to introduce Dr. J. B. Garner who will pre-

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sent to us for our information and education a paper on the subject of "The Chemical Possibilities of Natural Gas". (Applause.)

DR. J. B. GARNER: Mr. President, Ladies and Members of The Natural Gas Association of America:

To have been invited to speak at this meeting of The Natural Gas Association of America on the subject of The Chemical Possibilities of Natural Gas I regard as a high honor and I, therefore, wish at this time to express my appreciation of those who are responsible for this invitation. I realize in the discussion of such a subject which is comprehensive and at the same time scientific and technical that I am liable to err with too much detail or with too many scientific and technical terms. In order that I might be clear I have placed in the printed address which is in your hands certain explanation of things which are purely scientific and technical. For the sake of definiteness and completeness I have added a tabulation containing details.

Dr. J. B. Garner then presented the following paper:

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"THE CHEMICAL POSSIBILITIES OF NATURAL GAS."

By Dr. J. B. Garner.

It is only in the past few years that producers of natural gas have given any attention to methods of utilization of it other than as fuel and illuminant. During the early history of the natural gas industry the supply greatly exceeded the demand — there was so much natural gas that there was no occasion for anyone to try to think of economizing in its use or of recovering from it valuable by-products. In fact the early years of this industry are ones of great waste. In localities where there was an abundance of gas, as in the Indiana field, factories were encouraged by local boards of trade to locate in the field; free sites and free gas were bestowed indiscriminately. The only returns which were expected from the wasteful use of gas by these factories was the industrial uplift which would occur to the community. Land speculators were eager for profit at any price. The natural gas industry has long been recognized as an important factor in the industrial development of the United States.

The general public is not responsible for this condition of affairs as it has been interested only in securing a priceless clean fuel at a ridiculously low figure. Producers likewise have been so interested in getting rid of their gas that they have sold it for the manufacture of carbon black by the wasteful process of incomplete combustion. Their efforts have been directed toward the sale of gas as a fuel and not to its utilization for chemical processes.

All of these conditions have been largely due to the enormous amount of natural gas. Producers have had no incentive to investigate the chemical possibilities of their product. It is only in the past decade that the more enterprising producers have interested themselves in the situation and have

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engaged scientific and technical men to undertake the study of these problems. The motto heretofore has been "let well enough alone." The fact that natural gas is a product whose chief use and value has been as a fuel has tended to obscure the fact that it is also a product of great chemical possibilities. The natural gas industry furnishes many promising lines of research. In reading over the proceedings of the Natural Gas Association of America the writer finds reference to the remarks of altruistic persons who have endeavored to interest gas producers in research.

The first question always asked of these altruistic persons is what will be the profits, not what are the possibilities. The appeals for scientific research on the possibilities of natural gas have for the most part been met with rebuff. Although the response on the part of the producers to the appeals of the scientific and technical men has been a long time in coming, it is quite clear to even the most casual observer that the whole natural gas industry is today responsive to the problem of the chemical possibilities of natural gas.

In the early development of the natural gas industry little thought was given to faulty valves, gates, couplings, regulators and other appliances connected with the drilling, production, transmission and distribution of natural gas. A goodly proportion of the gas that was produced was lost for the reasons that the appliances used were faulty. These were at once obvious and apparent. The producer could easily see his potential profits dissipated into the air and as the result of the situation, he was forced to go to the engineer to devise for him new and less wasteful methods of handling his gas. The value of the results of the work of the engineer along these lines was at once recognized because of the increased balance on the right side of the ledger. The producer was convinced that the engineer was a necessary adjunct to his business. Later on when well pressures declined and it became necessary to install large compressing stations, gas cooling coils, etc., the need of the engineer became more and more apparent, because of the numerous mechanical and electrical problems which arose from the successful operation and maintenance of gas compressing

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stations. The most enterprising of these companies secured the services of highly trained as well as intensely practical scientific and technical men. There is no country on the face of the earth which is so highly specialized in the compression and transmission of high pressure gas.

Simultaneously with the installation of machinery for the artificial compression of natural gas in order that it might be economically transported to market, there was a decided lowering of the pressure on the well. Perhaps as a consequence of the lowering of the well pressure it has since been discovered that some less volatile gas was obtained and by the process of compression and the consequent cooling of the gas minor quantities of these less volatile hydrocarbons were sometimes deposited as liquid in the transportation lines. This usually took place in cold weather, and occasionally this liquid would collect at a low point in the line in association with quantities of water and would interfere with the transportation of the gas. At low temperatures the water would freeze and the result would be the bursting of the pipe line. Not only were large quantities of gas lost when this happened, but the service to the customers who needed the gas was interfered with at a particularly inopportune time. The deposit of these liquid hydrocarbons also sometimes injured the rubbers of the couplings to such an extent as to render it a nuisance to the producer. The producer therefore again consulted the engineer, and drips were devised in which the liquid deposited in the pipe line could be periodically removed without interfering with the transmission of the gas. The liquid hydrocarbons thus collected when separated from the water came to be known as drip gasoline. It was not obtained in quantities sufficient to render it an article of commerce, though quantities of it were sometimes sold to refineries.

At about this time an enterprising and far-seeing chemical engineer, George M. Saybolt, conceived the idea, contrary to the general notion, that there might be enough of the heavier hydrocarbons existing in the form of vapor in natural gas to justify an effort for their commercial extraction in liquid form. Starting with this idea Mr. Saybolt invented a method of ex-

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tracting these vapors and engaged in a series of experiments under the auspices of a large natural gas producing company which interested itself in his work. The result of Mr. Saybolt's experiments was the conviction not only that gasoline could be extracted from natural gas, but that the process which he had invented was a highly successful one for that purpose. The first plant for obtaining gasoline by his method was installed and placed in operation in August 1913, and soon another surprising fact was learned, namely, that the gasoline so obtained was one of a particularly high quality and different from any other then on the market.

You are all conversant with the growth and development of this remarkable natural gas gasoline industry. It is now perfectly apparent to any one connected with the natural gas industry that gasoline can be extracted in commercial quantities from natural gas and that adequate returns are to be had from the investment required. Ten years ago, however, the story was different. All of this progress, development and growth in this industry we owe to the pioneer efforts of the chemical engineer — George M. Saybolt.

COMPOSITION OF NATURAL GAS

Natural gas is composed almost entirely of paraffin hydrocarbons in varying proportions, — methane, ethane, propane, butane, pentane, hexane, heptane and octane. Nitrogen, carbon dioxide, and helium may exist in small quantities. The first two of the hydrocarbons are fixed gases, that is, gases which liquefy only at very low temperatures and high pressures. Propane and butane are normally regarded as gases but are intermediate in their properties between a true gas on the one hand and a true liquid on the other hand . Pentane, hexane, heptane, and octane are normally liquids at atmospheric temperature and pressure. Most commonly methane is the predominating constituent and octane is the hydrocarbon which occurs to the least extent in natural gas.

These compounds are called "Paraffin Hydrocarbons" because they are thought to be compounds which show little or

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no chemical reactivity. This means in other words that they are substances which, when subjected to forces that bring about chemical change, undergo this change only with the greatest difficulty, or only when in contact with the most energetic chemical reagents.

Chemical change refers to any change in a substance which affects its composition, or, to put it in other words when a substance undergoes chemical change the identity of the substance is lost. For example, — when natural gas is burned in air both the air and the natural gas undergo chemical change, since the product resulting from the burning of the natural gas in the air is entirely different from either natural gas or air. The products of this chemical change are carbon dioxide, water and nitrogen. The product is no longer valuable as fuel or illuminant, or capable of sustaining animal life. A definite and fixed quantity by weight of both natural gas and air have been required to bring about, under a certain set of conditions of temperature and pressure, this chemical change. This explanation is offered, so that a clear understanding may be had of that which constitutes chemical change.

Chemical changes in general are effected in two ways: —

First: The substance which is to be studied chemically is subjected, in the absence of all other substances, to some form of energy, as light, heat or electricity.

Second: The substance which is to be subjected to chemical change is placed in contact with a definite weight of another substance, and the mixture subjected to some form of energy in the presence or absence of small quantities of a foreign material known as a catalyst. Catalysts have for their purpose the hastening or retarding of the final state of the change.

The first of these methods of effecting chemical change is illustrated by the following two well known reactions:

First: When ordinary sugar is heated, the final results of the heating are carbon and water.

Second: When high boiling petroleum distillates are heated under pressure at temperatures from 500 to 550 degrees C., "cracked" gasoline is produced, while if the temperature is from 650 to 750 degrees C., aromatic hydrocarbons such

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as benzol and toluol are produced. In order to understand the chemical changes which have occurred by the simple heating of these substances, it may be well for us to visualize all substances as being of a grained structure, and that the grains composing the structure are held together by a pull force, i. e., a force which tends to keep the particles or grains together. The pull force which holds together the atoms of hydrogen and carbon making up the substances we know as methane, ethane, propane, etc., is called chemical force or chemical affinity. So long as this pull force is in excess of any external force tending to separate the atoms from one another or push them apart or rearrange them, the substance does not undergo any chemical change, but when that situation is reached where the external energy is stronger or greater than the energy which holds the particles together, chemical change results. Thus, when a substance is heated, energy in the form of a separating force is being added to the substance. The addition of this energy to the substance intensifies the motion of the particles making up the substance, and thereby lessens the chemical affinity which holds them together. If the rapidity of motion of the atoms composing the substance becomes so great that the particles no longer can hang together due to the action of chemical affinity, a chemical change takes place; or in other words, chemical affinity ceases to act when the atomic vibrations reach a certain limiting value.

The second of these methods of effecting chemical change is illustrated by the following series of experiments which will be performed here at the table. I have here what is known in chemical laboratories as a Kipp apparatus. This apparatus contains in the middle portion some ordinary granulated zinc. The upper and lower portions contain dilute sulphuric acid. When the zinc and sulphuric acid are brought into contact by manipulation of the stopcock from the middle portion, hydrogen is produced, and escapes through the opening in the stopcock. Attached to this stopcock is a piece of rubber hose, terminating in a small piece of glass tubing drawn to a capillary. You will observe that upon opening the stopcock, hydrogen gas escapes into the air, and that this escape occasions nothing more than

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the admixture of hydrogen with the air — a change similar to that which would occur when a valve on a gas line is opened. I have here a piece of iron wire which I will heat to several temperatures, so that I may expose the stream of hydrogen gas as it mixes with air to different degrees of heat, the purpose being to show that this mixture of hydrogen and air must be raised to a definite temperature before the hydrogen will burn and thus undergo a chemical change. You will observe that when the iron wire is heated to a slight extent, the hydrogen does not burn, but when the wire is heated to redness, burning results. The exact temperature at which hydrogen in the presence of air begins to burn is 700 degrees C. By this experiment, I have shown that hydrogen, when mixed in air requires the addition of a certain amount of energy to cause these two substances to undergo chemical change at a noticeable rate. Energy in the form of electricity might have been added here with similar results.

In order that you may have some tangible and definite idea of what a catalyst is, I have prepared some platinum black, and have it here in this bottle. This platinum black has been prepared by taking some asbestos fibre, moistening it with a solution of platinum chloride, and then heating the mixture red hot. This sample of platinum black is nothing more or less than asbestos covered with finely divided metallic platinum. Platinum black is a catalyst widely used commercially. You will notice that this platinum black is cold. I will now introduce it into this stream of hydrogen, and you will observe the effect of this catalyst upon the mixture of hydrogen and air. The hydrogen bursts immediately into flame, and the results are the same as when the hydrogen was heated to a definite temperature by means of the iron wire. I do not know why or how platinum black causes this chemical change to take place, but you know that it does take place very readily, and at much lower temperatures than we had.

So much then for the above general presentation of the chemical characteristics of the constituents of natural gas, what chemical change is, and how chemical changes may be induced

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or caused to take place. We are now in a position to begin our study of the chemical possibilities of natural gas.

In order that this subject may be simplified and at the same time made more intelligible, I desire to direct your attention, in the first place, to the processes which have for their purpose the separation of natural gas into its constituents; in the second place, to the chemical changes which natural gas as a mixture, or its constituents separately, will undergo when subjected to heat under varying conditions; and in the third place, to the change which the constituents of natural gas will undergo when subjected to chemical change in the presence of other substances with and without catalysts; and in the fourth place, to the valuable by-products which may be obtained by synthetic chemical reactions from the exhaust gas of gas engines.

Since August 1913 when the Hope Natural Gas Company installed the first absorption gasoline plant for the recovery of gasoline from natural gas, the natural gas-gasoline industry has experienced a rapid and remarkable growth. There are in existence at the present time more than 100 plants in the United States with a conservatively estimated production for the year in 1918 of more than 90,000,000 gallons. The extraction of gasoline by this method has in no way affected the value of natural gas as a fuel. It has made the production of natural gas more profitable; it has made the service to consumers more efficient, less interrupted, and more satisfactory. It has been one of the most important factors devised or invented having to do with the conservation of our natural gas resources. Probably no other factor has been so noteworthy in this direction. It has not only utilized and saved that which was formerly wasted, but it has enabled producers of motor fuel to meet the demands of the market for this material in a manner which would have been exceedingly difficult if at all possible in the present status of the oil industry. Petroleum distillates which of themselves are not utilizable as motor fuels are, when blended with natural gas-gasoline converted into satisfactory motor fuels. From the nature of the occurrence of gasoline as vapor in natural gas, one can readily understand why natural gas-

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gasoline contains relatively far more of the lower boiling hydrocarbons, pentane and hexane, than is contained in refinery gasoline. It is the relatively large proportion of these two hydrocarbons that gives to natural gas-gasoline its greater value, and that has to the present time made it an article of great chemical importance.

At the outbreak of the present great World War, unusual chemical demands were made of American industry. One of the foremost of these demands was for explosives or munitions. A chemical compound known as amyl acetate is extensively used in the explosive industries. Prior to the war, Germany furnished practically all the world's supply of this material. All that was made in America was made from amyl alcohol and acetic acid. A review of the patent literature discloses that there were numerous German patents by means of which this product could be prepared from pentane. American manufacturers facing the shortage of this material, and knowing that the requirements would be great, went into the gasoline market, and asked that special cuts be made so that they would be provided with sufficient pentane which they could utilize for the manufacture of this product. On account of the fact that the United States Government has been lax regarding exact disclosures in the patents granted, especially to Germans, it was necessary that American industry should employ skilled and competent chemists to endeavor to find a method by means of which amyl acetate could be manufactured at a reasonable cost and in sufficient quantities to meet present day requirements. The work required of American chemists was rendered more difficult on account of the confusion which arose over incorrect disclosures in the patents already granted than if there had been no published data regarding any processes whatsoever. The whole ground had to be worked over thoroughly and carefully. As a result of the work of these chemists a process was invented, a plant was installed, and quantities of material adequate for all present-day demands produced. The DuPonts at Wilmington, Delaware, have had in operation for two years a plant for this purpose. The process consists essentially of taking natural gas-gasoline and subjecting it to fractional dis-

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tillation. The fraction which distills over at from 40 to 70° C. and which is essentially a solution of pentane and hexane, is brought in contact with Chlorine in the presence of ultra violet rays of light, until a certain amount of Chlorine has been absorbed by this fraction. This chlorinated mixture is then subjected to a washing and distilling operation. In the distilling operation, a fraction is selected, whose chief constituent is amyl chloride, or pentane in which one Hydrogen atom has been displaced by one Chlorine atom. This amyl chloride is then mixed with sodium acetate and the mixture heated under pressure. Common salt and amyl acetate are the products of the change which occurs. The separation of these two compounds is readily and easily effected. Amyl acetate has the following commercial uses, — solvent for pyrocollodion, collodion, plotocotton and pyroxylene. Pyroxylene is used in the manufacture of artificial silk, imitation leather, waterproofing compositions, celluloid, and photographic films. Pyroxylene lacquers and amyl acetate are used for metallic surface coverings.

It appears to the speaker that the chemical possibilities of hexane, heptane and octane are ever greater commercially than those of pentane. One of the greatest of the demands made upon American industry and in fact upon world industry since the beginning of this great war is that of fatty acids, i. e., acids which are derived by chemical changes more or less from vegetable and animal tissues. The supply from living sources has not been equal to the demand, and industry, in order to meet the pressing requirements, has been compelled to look to mineral sources as a base of supply. Upon high authority the statement has been recently made, — "It is not improbable that Germany to-day is supplying a large part of her fats from synthetic production, with mineral oils as a base of supply." It would be entirely foreign to a meeting of this general nature to enter into a detailed discussion of the changes which would be involved in the obtaining of fatty acids from these hydrocarbons of natural gas-gasoline, but it is not a dream or a product of the imagination when I state that it is entirely feasible by well known and well tested chemical reactions and methods of synthesis to prepare a fatty acid from these hydrocarbons

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that will have the same composition, same food value and same uses as the corresponding acid derived from natural fats. Numerous instances can be cited from scientific literature which will convince anyone of the correctness of this statement. To have made the statement ten years ago that gasoline was a potential force in supplying a part of the food requirements of the nation would have been regarded as fanatical and impossible. (Those who are especially interested in these chemical possibilities of the hydrocarbons of natural gas-gasoline are respectfully referred to a very complete and comprehensive article on the subject contained in a journal called "Metallurgical and Chemical Engineering" of March 15, 1918, pages 308 to 311.)

Within the past year, many of the newspapers and most of the popular magazines have contained articles descriptive of the recovery from coal and coke oven gas of benzol and toluol, and the manufacture from these substances of high explosives, important drugs and medicines and a widely used coal tar dyes. These articles have appeared as a result of a desire on the part of the American people to learn of the demands which are being made upon American industry by the nations at war. Germany had formerly supplied practically the entire world with these substances, and when the German supply had been cut off, such a demand had been created that it was necessary that some nation not at war provide ways and means of meeting these requirements. Plants for the recovery of benzol and toluol from coke oven gas have been installed throughout this country with such remarkable rapidity and on such a colossal scale that American industry can today, if called upon, furnish the entire requirements of these materials for the world on a war basis. The scientific investigation which preceded and has gone along with the development of this great American industry, shows clearly some additional chemical possibilities which natural gas-gasoline may have. The mother substance of all the so-called coal-tar drugs, medicines, explosives and dyes is benzol. Benzol does not exist as such in coal from which coal or coke oven gas is derived, but is formed by the chemical change which occurs under definite conditions when the coal is heated. It has been conclusively shown by a large number

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of chemists that when coal is caused to undergo chemical change at low temperatures, benzol or aromatic hydrocarbons are formed. I have mentioned previously in this address that high-boiling paraffin petroleum distillates when heated to 500 to 550° C. gave what is called "cracked" gasoline, and when heated to 650 to 750° C. gave aromatic compounds. "The speaker has personally conducted experiments with propane and butane and the gasoline hydrocarbons under varying conditions of temperature in the presence of catalysts like nickel and iron, and found that benzol and toluol can be prepared from them. It seems therefore quite clear that if the proper time, attention and thought were put upon the problem, that a commercial process, economical and satisfactory, could be devised, whereby the hydrocarbons composing natural gas could be converted into benzol and toluol, or in other words, if necessity required, natural gas-gasoline could be made the basis of the coal tar, drug, medicine, explosive, and dye industries."

It has long been noticed in the operation of absorption gasoline plants that there were heavy hydrocarbon vapors that were not condensed at atmospheric pressure by the condenser directly connected to the stills in the distilling operation. Early in the industry, these vapors were permitted to escape, either into the air, or were passed into a low pressure fuel line. Later on, these vapors were collected and handled in a small compressor, and as a result of the compression and subsequent cooling, considerable yields of high gravity gasoline were secured. This practice is now a general one in absorption gasoline plants. The uncondensed gases from this tail house compressor have for the most part been either put into suction lines or into fuel lines. In some few instances, the compressor which is used on these vapors is a two-stage one, in which pressures of from 100 to 150 pounds are maintained on the discharge. When such compressors are used, the product produced in the second stage of the compression, or in the low stage if the pressure is above 50 pounds, contains highly volatile liquid. If the liquid produced under such circumstances is trapped or blown off into run or storage tanks, the product undergoes weathering, which means nothing more or less than that the

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material is permitted to remain in the tanks until the highly volatile portion has evaporated. In the majority of these cases, the weathering or evaporation products are permitted to escape into the air. This practice has been nothing more or less than criminal waste, for every producer of natural gas-gasoline has known that under no circumstances can this material be delivered to market in ordinary tank cars, and that although he has spent his money for equipment and power in producing it, he has received no financial return from it. It seems incredible that the commercial possibilities of extracting liquid by-products should have been unnoticed for so long a time.

As the natural gas-gasoline industry developed and its possibilities become well known, leaders in the natural gas industry, as a result of their studies in determining the best conditions of operation of gasoline plants, realize that there could be extracted from natural gas other by-products of a liquid nature, which were too highly volatile for use and shipment as gasoline. Recent discoveries have disclosed the utility and value of the propane and butane constituents of natural gas when they are substantially free from other constituents of the gas. A process has been devised for the recovery of these two substances in liquid form along with the recovery of gasoline from natural gas. The plan which will produce these two substances is made as an adjunct to the absorption gasoline plant. It can be easily and cheaply installed, and can be operated with very low operating cost as the operating conditions require no additional attention other than that which the men regularly employed on a gasoline plant can give to it without neglecting their other duties. One plant has already been installed for the manufacture of both liquid butane and propane. Since May 31, 1917, it has been possible to produce at this plant approximately 2,200 gallons of liquid butane and 2,000 gallons of liquid propane, per day.

In practicing the process for the recovery of substantially pure liquid butane and liquid propane, the by-product vapors from the condenser consisting of a mixture of propane, butane, some pentane, hexane and fixed gases are passed under pressure under a definite set of conditions through an absorbent oil

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This treatment is for the purpose of removing pentane and hexane. The remaining vapors — substantially a mixture of propane and butane, are, under a given set of temperature conditions, subjected to pressure. This results in the condensation of a highly-volatile liquid product from which liquid butane is commercially produced. The remaining uncondensed propane vapor is again subjected to a compressing and cooling operation, and a liquid portion is obtained, from which substantially pure liquid propane is obtained. The products as obtained by the process thus briefly described have the following average physical properties, —

LIQUID BUTANE is a clear, colorless, mobile liquid with a gravity of 106 to 108° B. at 32° F.; it has a heating value of about 3,400 b. t. u. per cubic foot. One gallon of the product when evaporated, produces 37 cu. ft. of vapor when measured at 60° F. and atmospheric pressure. The gravity of the gas or vapor produced varies from 1.98 to 2.02, air equalling one (1). The boiling point of the liquid at atmospheric pressure varies from approximately 29° F. to 34° F. The following temperature-pressure relations, when this product was confined in a steel cylinder were found, —

Degrees F.	*Pressure Gauge.*
44	55
60	65
71	83
81	98
92	112
103	129

Latent heat of evaporation at one atmosphere and 32° F. — 164 b. t. u. per pound.

LIQUID PROPANE is a clear, colorless mobile liquid, gravity 128 to 131° B. at 32° F. Heat value, 2,600 b. t. u. per cubic foot. One gallon of the product upon evaporation will yield 45 cu. ft. of gas or vapor at 60° F. and atmospheric pressure. The gravity of the gas produced is 1.51 to 1.54. The boiling point of the liquid at atmospheric pressure is approximately ½-49° F. The following temperature-pressure relations, when this product was confined in a steel cylinder, were found, —

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Degrees F.	*Pressure Gauge.*
47	438
59	453
70	470
81	500
91	524
100	555

Numerous practical and engineering tests have been made on both of these products. They have been found suitable for the lighting and heating of homes and buildings in regions remote from the gas fields. The ordinary commercial appliances in the way of burners and stoves have been used in these experiments. The re-adjustments which have been required in these common devices for the economical and satisfactory use of those products have been learned. Tests have been made with those gases as a source of power for stationary engines and automobiles. In the work of adapting these products for motor fuel purposes, the speaker has had the hearty co-operation of Drs. Raymond F. Bacon and Harry Essex of the Mellon Institute, and Mr. Barber, an experienced internal combustion engineer. The results of the work carried on clearly indicate and prove that not only can those substances be used with the ordinary equipment of internal combustion engines, but that the carburetor can be entirely done away with, and in its stead a gas mixer be used. The following road and maximum power tests will be of considerable interest:

RECORD OF ROAD TEST USING BUTANE AS FUEL JULY 9-10, 1917

Machine	Crawford 45 h.p. using gas mixer in place of carburetor.
Weight	Empty 3,750 pounds; loaded 4,750 pounds.
Run consisted of	21 miles Pittsburgh city driving, 111 miles country-mountain driving.
Location of run	From Pittsburgh to the east side of Laurel Ridge (beyond Ligonier, Pa.) and return.
Gas supply	In three (3) cylinders, containing 78 pounds of Butane.
Total gas used	58 pounds.
Total mileage	133 miles.
Miles per pound	2.3 miles.

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Miles per gallon..... 11.5 miles.
Adjustments made ..... 70.
Connections made ..... 21.
Stops to change tanks, etc.. 40.

NOTE: Each stop necessitated re-adjustment and large loss of gas —unnecessary with proper tanks and purest gas.

COMPARISON WITH GASOLINE

The same Crawford car, equipped with Stromberg carburettor on the same run with three stops gives 9.3 miles per gallon of 76° gasoline.

With forty stops, and the same number of adjustments, the mileage would be less than five miles per gallon of gasoline.

In addition to this excellent mileage shown, the oil requirement was cut over 50 per cent. But one quart of oil was put into the system and not over three-quarters quart used. Ordinarily with gasoline on this run, two quarts are necessary.

REMARKS

The run as recorded above was made on a very bad day. Rain fell hard for at least four of the ten hours' time and the air temperature was from 52° to 60°, giving little chance for gasification by heat; also the roads were necessarily slippery.

The engine at no time failed to give the proper mixture and could be throttled down to five miles per hour on a 12 per cent grade without stalling or missing a single explosion. This cannot be done with any four cylinder car using gasoline.

In the maximum power tests which were conducted at the Mellon Institute, a Dodge Motor was used. Various fuels were tested, and the total horse power developed by all the fuels used did not vary from one another more than one per cent, or easily within the limits of experimental error. Carburetor was adjusted and spark was advanced to maximum power. The temperature of the exhaust gases varied from 640 as a minimum to 655° C. as the maximum.

In our work with the stationary engines, we have found that one cubic foot of propane is equivalent to almost two and one-quarter feet of ordinary natural gas, and that one cubic foot of butane is equivalent to approximately three cubic feet of ordinary natural gas. This is the relationship which could have been anticipated from the relative heating values of the

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different products. In addition to the uses cited above for these by-product liquids, other important uses have been discovered and appliances for their satisfactory use commercially devised — namely, for the purpose of the cutting of metals and of making incendiary bombs for offensive warfare work. The latter one of these uses will be omitted from the discussion of this paper for obvious reasons. The former of these uses will be demonstrated to you. (Demonstrated.) The credit for working out the details of the torch used for metal cutting is due to James and Harry Anderson of the N. C. Davisson Burner Company. Liquid butane and liquid propane have both been successfully used by these same gentlemen for the welding of cast iron, aluminum and other metals. Work is in progress which has for its purpose the development of a torch, which will enable these materials to be used for steel welding. The speaker has every reason to believe that this torch will soon be available for sale on the American market. In accordance with the Interstate Commerce Commission specifications No. 6 for shipment of liquefied petroleum gas of not over 150 lbs. charging pressures, cylinders may be used which are seamless, or of welded or brazed construction, and must show a test pressure of 600 lbs. Butane does not require 150 lbs. charging pressure. It is therefore possible to ship liquid butane in accordance with these specifications in cylinders which will weigh from one-eighth to one-third that of the cylinders now used in interstate commerce shipments, of gases which are used for similar purposes. This gives butane a marked advantage in freight and express shipments. In addition, the cost of these cylinders should not be in excess of forty per cent. of the other cylinders which are in use commercially.

Another added advantage in the use of butane is its remarkably narrow explosive range. The following may be of interest with reference to the explosive limits for mixtures of various commercial gases, —

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Natural gas	5 to 11½% of gas.
Methane	6.1 to 12.8.
Coal gas	7.9 to 19.1.
Acetylene	3.3 to 52.3.
Hydrogen	9.45 to 66.4.
Butane	3 to 8

It is clear from the above that butane is the safest to use of all commercial gases.

It is apparent from the above program that there are tremendous possibilities from the recovery and therefore the use of these liquids, highly volatile products of natural gas. A discussion of other possibilities of these substances is deferred to another section of the address.

CHEMICAL CHANGES WHICH NATURAL GAS, AS A MIXTURE, OR ITS CONSTITUENTS SEPARATELY WILL UNDERGO WHEN SUBJECTED TO HEAT

Early in October of 1915 the speaker, in connection with his assistants, began a preliminary study of the effect of heat on natural gas.

They made use of electrically heated fused Quartz or Shelby steel tubes. Experiments were made both in the presence and absence of catalysts and the influence of these substances on the decomposition under temperature ranges of from 400° C. to 1400° C. studied. The catalysts used were pumice-nickel, pumice-copper, charcoal, finely divided copper, finely divided iron, aluminum, aluminum chloride, and silica. It was found that the decomposition, whatever took place in the presence of these catalysts varied in a manner that was characteristic for each catalyst. For example, one catalyst, under a definite set of conditions, gave a high percentage of acetylene while another produced none.

There has been quite a lot of work done on the thermal decomposition of the paraffin hydrocarbons but as far as the speaker is concerned he is not aware of the industrial application of the results of the majority of this work. The patent,

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scientific, and technical literature contains much information relative to the subject.

In the experimental work which the speaker did the following products were used:

(a) Natural gas as is delivered to the City of Pittsburgh; (b) vent tank gas; (c) propane; and (d) butane.

All of the samples of these gases were carefully analyzed and tested and their properties tabulated. The gases were then caused to pass through the apparatus provided for their study under varying conditions of temperature, pressure and rate. A photo of the apparatus is given below.

From the photograph it will be observed that the apparatus consists of the following parts:

(a) A steel cylinder in which the gas to be studied is confined.

(b) Wash bottles which contain a liquid to indicate the rate at which the gas is passing.

(c) An apparatus which determines the exact amount of gas passing per minute.

(d) An electrically heated furnace.

(e) A tube in which the chemical changes take place.

(f) Rheostats.

(g) A pyrometer for accurately measuring temperatures in the furnace.

(h) A coil condenser for the separation of liquids, tars, and solids.

(i) A discharge gas tube.

(j) A calibrated cylinder for the collection over water of the discharge gas so that its volume, composition, and properties can be studied.

In order that this address may not be made tedious by the introduction of tabulations of results these have been omitted and will be published subsequently in a scientific and technical journal. It is sufficient, upon this occasion, to state that the experimental results were most gratifying in that the conditions of experimentation were learned whereby natural gas as a mixture, or its constituents separately, will undergo pro-

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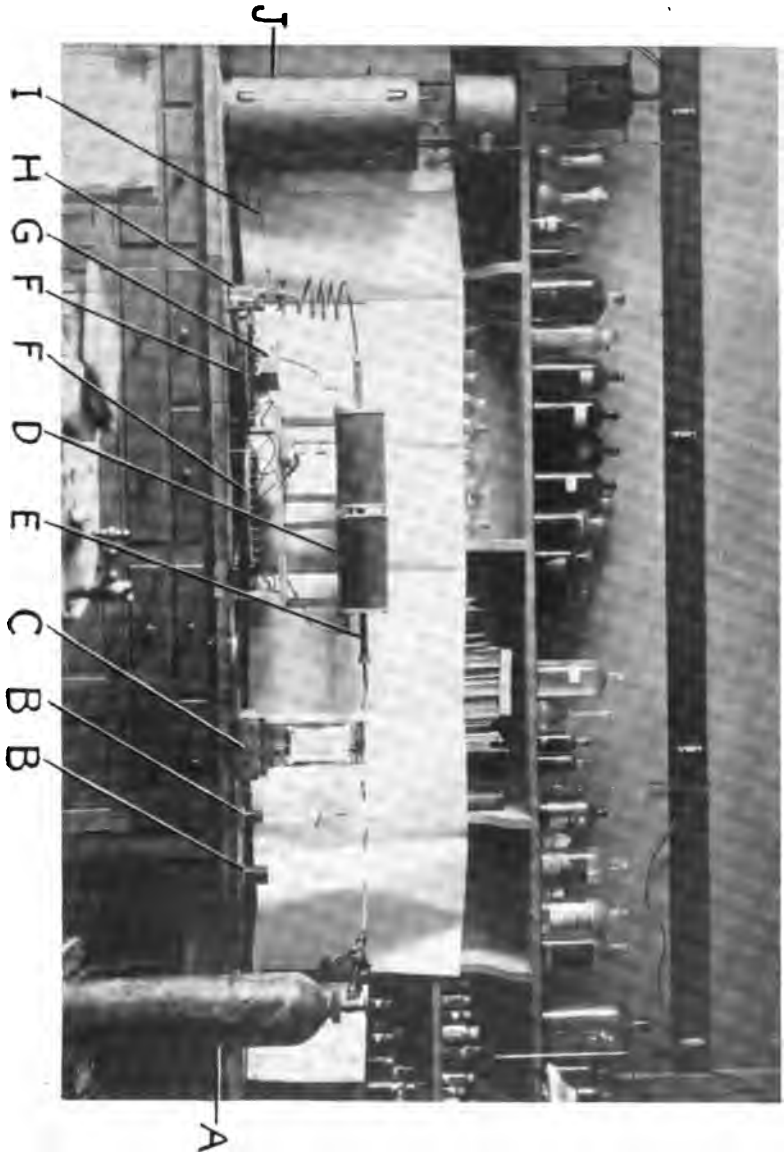

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found chemical changes when subjected to heat under varying conditions. Carbon black, unsaturated hydrocarbons, of both the olefines and acetylene series, and hydrogen are the direct and only products which are obtained when one set of conditions is observed, while on the other hand when another set of conditions is observed in addition to the products mentioned, benzol, toluol, naphthalene, etc., are produced.

The industrial application of the results of our experimental work has, so far, been confined to that set of conditions which had for its purpose the production of the greatest yield of the highest quality of carbon black. In the two plants which have been built the following are the representative results:

Kind of Gas.	*Ratio of gas passed to gas collected.*	*Carbon Black formed; lbs. per 1000 cu. ft.*	*B. T. U. of discharge gas.*	*B. T. U. of Inlet gas.*	*Per Cent. Unsaturated Hydrocarbon.*
Nat. gas	1.27	4.52	840	1142	6.75
Vent gas	1.42	6.44	861	1347	12.9
Propane	2.63	26.9	866	2600	26.2
Butane	2.99	38.2	702	3400	26.6

It will be observed, first, that natural gas, as a mixture, gives a yield of carbon black three times as high as that usually obtained by the wasteful process of incomplete combustion; and that the yields from the other gases are far in excess of those obtainable from ordinary natural gas.

Second: That the discharge gas is larger in volume than the inlet gas by ratios varying from 1.27 to 2.99. The heating value of the discharge gas is of necessity much lower in value than the inlet gas; however, the discharge gas has a heating value much superior to that of any artificial gas. The discharge gas is therefore a commercial one and if carbon black is the only product desired this gas can be put into the usual channels for delivery to market.

Third: That the discharge gas contains unsaturated hydrocarbons of the olefine series, mostly ethylene and that the amount varies from 6.75% to 26.6%. The olefine hydrocarbons are present in artificial gas and in a large measure are responsible

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for its luminosity. If it is desired these unsaturated hydrocarbons may be used by simple chemical reactions for the manufacture of:

(a) Glycols,

(b) Industrial alcohol, acetaldehyde, acetic acid, acetone.

(c) Chlorinated olefine solvents.

It is well known, in organic chemistry,

First: that members of the olefine series of hydrocarbons when treated under the proper conditions with potassium permanganate yields glycols.

Second: That olefine hydrocarbons when treated under the proper conditions with sulphuric acid yield compounds which on treatment with water give alcohols and regenerate the sulphuric acid.

Third: Olefine hydrocarbons when treated directly with chlorine absorb the chlorine chemically and yield chlorine derivatives.

The glycols are, as a general rule, thick, colorless liquids and have a sweet taste. They are miscible with water and alcohol in all proportions. Recently these substances have been utilized as substitutes for glycerin in the manufacture of medicine, drugs, explosives, etc.

The extensive commercial use of alcohol is too well known to need much discussion. The largest commercial uses of industrial alcohol are for solvent purposes in the manufacture of organic dyes, varnishes, explosives, perfumes, tinctures, etc. Since the opening of the European War large demands have been made upon the alcohol industry for ether, acetaldehyde, acetic acid and acetone. All these substances may be obtained by simple well-known chemical reactions from industrial alcohol.

The chlorinated olefine derivatives have for the past few years been made in large quantities by other methods and have found extensive use in the rubber industry.

I have pointed out above that carbon black and olefine hydrocarbons can be produced from natural gas or its constituents separately. I have further pointed out the chemical possibilities of the olefine hydrocarbons. If both carbon black and

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olefine hydrocarbons are recovered from natural gas and utilized in any of the ways mentioned above there is left a residue mostly composed of hydrogen. This residue can be easily converted into a practically pure product by subjecting it to heat at a temperature slightly in excess of 1400° C. The opportunity therefore is open for the manufacture of pure hydrogen from natural gas, Hydrogen as is well known is used largely in war times for balloon purposes; however, its largest peace-time use is in the hydrogenation or hardening of oil. Tremendous quantities of cottonseed and other edible oils are readily converted by means of hydrogen in presence of nickel as catalyst into solid products or fats which have wide economic and industrial importance.

It can thus be seen that by the decomposition of the natural gas or its constituents separately, valuable products can be obtained which have almost unlimited possibilities.

CHEMICAL CHANGES WHICH NATURAL GAS, OR ITS CONSTITUENTS WILL UNDERGO WHEN SUBJECTED TO CHEMICAL CHANGE IN THE PRESENCE OF OTHER SUBSTANCES AND WITHOUT CATALYSTS

This section of the address will be limited to the discussion of the chemical changes which occur when natural gas, or its constituents separately, are treated with the following reagents:

(a) Air, oxygen being the active component.

(b) Chlorine.

(a) Reactions with air or oxygen.

The use of material gas as a fuel is nothing more or less than the taking advantage of the heat evolved when natural gas reacts chemically with the oxygen of the air. The chemical change which occurs results in the conversion of the paraffin hydrocarbons of natural gas into carbon dioxide and water. The formation of carbon dioxide and water is the final result of a whole series of intermediate chemical changes. It is to these intermediate chemical changes that I desire to call your particular attention at this time. Considered from the theoretical

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viewpoint, methane, the predominating component of natural gas, should yield, when treated under the proper conditions with air or oxygen, the following substances:

Methyl alcohol, formaldehyde, formic acid or carbon monoxide, carbon dioxide, and water.

H. S. Blackmore, United States Patent No. 774824 of November 15th, 1904, claims to have invented a process whereby methane when heated under a temperature of 260° F. with various metallic oxides as a source of oxygen obtains from 1500 cu. ft. of methane, 125 pounds of methyl or wood alcohol and at a temperature of 315° F. from 1500 cu. ft. of methane produces 118 pounds of formaldehyde. The metallic oxide used as a source of oxygen were ferroso-ferric oxide, cupric oxide, and manganese and barium dioxides.

In United States Patent No. 891753 another investigator has found that when methane is treated at temperatures from 86° F. to 122° F. with air in the presence of oak bark as catalyzer he obtains from less than 1 cu. ft. of methane slightly less than 4 pounds of formaldehyde. He also claims that small quantities of methyl or wood alcohol and formic acid are produced. An abstract of this work may be found in the Journal of the "Society of the Chemical Industry," Volume 27, page 918.

Glock, in German Patent No. 109014 claims that methane and air in equal volumes when passed through a tube containing granulated copper as a catalyst yields at a temperature of 112° F. formaldehyde in commercial quantities. Numerous other investigators as Otto, Coquillon, Bone and Smith, and Bone & Wheeler, have made similar observations, viz., that methane in the presence of air and catalysts at certain temperatures yields formaldehyde.

Dennis and Hopkins in the Journal of the American Chemical Society, Volume 21, page 309, give a description of a laboratory method of converting methane into carbon monoxide.

The speaker has personally investigated the conversion of methane into carbon monoxide and finds that under the proper conditions, to-wit: — (a) Relative values of methane and air interacting; (b) Presence of certain catalysts; (c) Definite rate

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of flow; and (d) Carefully regulated temperatures; that it is possible to convert methane into more than 90% of the theoretical quantity of carbon monoxide. This particular phase of the chemistry of methane was studied on account of the commercial importance of the following products which can be derived from carbon monoxide by simple chemical changes: (1) Carbonyl chloride or phosgene, (2) Formic acid, and (3) Oxalic acid.

Carbonyl chloride is used very extensively at the present time in offensive gas warfare and in the synthetic dye industry. It commands a price which is quoted as nominal. This means that the product is difficult to obtain and then only at a good price. Formic and oxalic acid find ready sale at from 35 to 45 cents per pound in large containers.

Lemoine and Senderens working independently in 1907 found that when carbon monoxide and chlorine in equal volumes are passed through a suitably constructed apparatus, containing wood charcoal as catalyst, react to produce quantitatively carbonyl chloride or phosgene. This is the commercial method of manufacture.

English Patents Nos. 4684 and 9008, French Patents Nos. 342168 and 421227 and numerous scientific articles describe processes for the manufacture of the salts of formic acid. These processes in the main consist of passing carbon monoxide in the presence of various catalysts at different temperatures into caustic soda, caustic potash and quick lime under some pressure to produce the salts of formic acid. These salts by simple treatment with sulphuric acid yield pure formic acid. This acid is manufactured on a large scale in Germany by this process.

If the salts of formic acid as prepared by the methods just given are heated to temperatures, ranging from 680° F. to 770° F., these undergo chemical changes resulting in the production of pure hydrogen and the salts of oxalic acid, from which oxalic acid can be derived by treatment with sulphuric acid. German Patent No. 229853 is a description of a process wherein 1% of borax or 5% of boric acid is used as catalyst. The optimum temperature is as given above and the yield is

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88% of the theoretical. German Patent No. 269883 is a description of a process for the manufacture of oxalates from formates wherein the best temperature is given as 725° F. to 752° F. V. Merz and W. Weith in Berichte, Volume 15, page 1513, describe a process whereby sodium formates when heated out of contact of air at a temperature of 752° F. is converted into 70% of the theoretical quantity of exalate.

The above instances of the chemical changes which occur when methane is burned either in the presence of air or oxygen, are given for the purpose of showing the state of the art. The speaker feels that it is entirely possible to develop commercial processes whereby the following substances may be produced from natural gas; — formaldehyde, formic acid, oxalic acid and carbonyl chloride.

(b) Reactions with Chlorine:

Since 1879 a great many chemists have devoted much time to a study of the problem of the chlorination of natural gas. Mallet has two patents on this subject — U. S. Patents Nos. 220397 and 880900. Professor Francis C. Phillips of the University of Pittsburgh has published more or less extensively on this subject in the American Chemical Journal. Elworthy holds French Patent 35291 and German Patent 222919 covering processes on this subject. Baskerville and Hamor of the College of the City of New York have done more or less extensive work in this field. McKay holds U. S. Patent 1009428. The subject, therefore, is one which has received more than passing attention. The industrial application of the reactions and processes described in any of the above mentioned literature or patents has not been made. In the fall of 1915 the speaker in conjunction with his assistants took up the study of this problem. The natural gas which was used was that furnished by the Equitable Gas Company to the Mellon Institute of the University of Pittsburgh. The chlorine used was liquid chlorine produced by the Electro Bleaching Company of Niagara Falls, New York. The conditions of experimentation were varied from time to time until optimum conditions of operation were learned. It was found that when a mixture of

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natural gas (5 cu. ft.) and chlorine (4 cu. ft.) was passed through a tube at a temperature of from 518° F. to 554° F. using clay, pumice, infusorial earth, or luminum chloride as catalysts, that a reaction occurred smoothly and regularly resulting in the production of the following substances: — methyl chloride, methylene chloride, chloroform, carbon tetrachloride and muriatic acid, together with small quantities of complex chlorinated hydrocarbons. Using the data derived from the laboratory work it was found by calculation that 1000 cu. ft. of natural gas when treated with 526.4 pounds of chlorine will give:

51.34 lbs. carbon tetrachloride, worth 15½c. per lb.
189.8 lbs. chloroform, worth 75c. per lb.
62.86 lbs. methylene chloride, market price nominal.
13.06 lbs. methyl chloride, market price nominal, and
567.00 lbs. muriatic acid, containing 37.9% of hydrogen chloride, worth 1¾c. per lb.

Both methylene chloride and methyl chloride can be easily converted into chloroform and carbon tetrachloride by another simple reaction, using metallic iron or ferric chloride as catalysts and the yields of chloroform and carbon tetrachloride increased.

There are many gas fields in the United States and Canada which are not only remote from market but which contain more than 95% methane and would thus be suitable for the manufacture of chloroform, carbon tetrachloride and muriatic acid. In consideration of the fact that practically all of the chlorine on the market today is manufactured at points where there is cheap power and that the gas spoken of is in regions remote from market it would be necessary for any natural gas producing company manufacturing these chlorinated products to install a plant for the manufacture of chlorine. Caustic soda and hydrogen in large quantities would be produced as by-products and these in turn would have to be disposed of or utilized profitably at the point of production. The success of industrial Germany along chemical lines is due to the fact that wherever an industry has been established and there are by-products resulting from this industry, additional processes have

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been installed or invented whereby nothing but finished products is obtained.

In other words, a program has been outlined which enables any one owning natural gas in regions isolated or remote from market to install a series of processes by means of which all of the natural gas can be utilized in a highly important and commercial way.

Not only have the chlorination reactions of natural gas, as a mixture, been studied but particular attention has been paid to the chlorination of butane. On account of the fact that butane is a mother hydrocarbon of the following substances: — butyl chloride and butylene chloride, it is from these substances that a large number of important commercial products are obtainable theoretically. Butyl chloride should, under the proper conditions of chemical change, such as are well known in the laboratory, yield butyl alcohol, butyl aldehyde, butyric acid and dipropylketone. Butyric acid is the fatty acid derivable by saponification from butter fat. Dipropylketone is a product which has the same commercial uses as acetone and many other additional uses in the explosive industry. Butylene chloride upon treatment with alkalies yields a hydrocarbon known as butadiene. This hydrocarbon is of practical interest as it is the one which is the basis of the artificial rubber industry. In the *Journal of Metallurgical and Chemical Engineering* of May 1, 1917, pages 513 to 518, can be found an article giving a rather comprehensive statement of the chemical changes required to produce artificial rubber from butadiene. British patent No. 15,254 gives two methods of producing artificial caoutchouc. The methods are as follows:

(1) Butadiene dissolved in benzol is heated ten hours at 150° C. for a number of days.

(2) Butadiene condensed at a low temperature by means of ether and carbon dioxide is kept in an autoclave at 90° to 100° C. for four days. In both cases the solvents, unreacted upon material and by-products, are distilled off in vacuo or by steam, and a rubber-like mass remains.

Harries, in the *Annallen*, 1911, pages 157 and 383 describes another method whereby butadiene or its derivatives are heated

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with dosium wire. The yield is almost quantitative and the product obtained may be vulcanized quite readily. British Patent No. 26,550 claims an advantage over the Harries process by conducting the operation in the presence of carbon dioxide. Matthews in British Patent No. 2,070 effects the same change in the presence of sulphuric dioxide. The process of Matthews is essentially as follows:

Butadiene or its derivatives are heated with sodium wire in the presence of benzol. Liquid sulphur dioxide is then added to the cooled solution and the mixture warmed in a sealed vessel at 40 degrees C. After some time the vessel is opened when the solution is found to be very viscous and in some cases set to a jelly. On removal of the sulphur dioxide the product will be found to be elastic and to resemble natural caoutchouc.

The products obtainable by the various methods are elastic, easily soluble in the ordinary rubber solvents, and capable of vulcanization. Many scientists are at work endeavoring to discover a process whereby artificial rubber may be produced at a cost which will enable it to compete with the natural product.

The present status of the artificial rubber industry is much more promising than the artificial indigo industry was in its inception. The demand for indigo was relatively small, while the demand for rubber products has grown with remarkable rapidity along with the automobile industry. It is not to be expected that a synthesis so difficult and complicated as that of rubber could be effected without a great expenditure of time, energy, and money. The ground work has been well laid and I believe that American industry which is to be at once the servant and master of world industry will not be found wanting in supplying all that is needed to develop a process for the production of rubber. Natural gas with its content of pentane and butane, which compounds can be readily and easily isolated, forms the hydrocarbon basis upon which the artificial rubber industry can be built.

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VALUABLE BY-PRODUCTS WHICH MAY BE OBTAINED BY SYNTHETIC CHEMICAL REACTIONS FROM THE EXHAUST GAS OF THE GAS ENGINE

About the middle of the 17th century Robert Boyle made the following statement:

> "The air is a confused aggregate of effluviums from such different bodies, that, though they all agree in constituting by their minuteness and various motions one great mass of matter, yet perhaps there is scarcely a more heterogeneous body in the world."

These words forcefully impress the fact that air is a mixture of several different gases. Oxygen, nitrogen, carbon dioxide and the rare or noble gases, are the main components of the atmosphere. Generally speaking the following is the average percentage composition of air, by volume, nitrogen 78.03; oxygen 20.99; rare or noble gases .95; carbon dioxide .03. Of the rare or noble gases argon exists in the largest quantity;— 1,000 volumes of air contain approximately 9.37 volumes or less than 1% of argon.

When air is mixed with natural gas and this mixture exploded in a gas engine the hydrocarbons of natural gas react with the oxygen of the air to produce carbon dioxide and water vapor. The other constituents of air do not undergo any chemical change. The exhaust from a gas engine contains, therefore, nitrogen, the rare or noble gases, carbon dioxide, and water vapor. It is to these substances that I would have you pay particular attention at this time. If the exhaust gas is cooled by passage through coils sprayed with ordinary water and then compressed to a pressure of from 25 to 30 pounds practically all, if not all, of the water vapor present would be removed as liquid water. The remaining gas after such compression could then be treated according to a French patent of Georges Claude, for the recovery of carbon dioxide. In principle this process consists in passing the gas containing carbon dioxide through a body of liquid water under pressure, keeping the gravity of the water at such a point that practically all of the carbon dioxide is dissolved by the water at the temperature and pressure used.

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The unabsorbed gases consist of nitrogen and the rare or noble gases. The water containing the carbon dioxide dissolved under pressure can flow to a suitably constructed apparatus in which the pressure is lowered.

The carbon dioxide thus evolved can be picked up by a compressor and liquefied and as such sold on the market for all the purposes as carbon dioxide prepared in other ways. R. F. Brownlee and R. H. Uhlinger have American patents No. 1,150,-337 and No. 1,154,172 covering processes for the manufacture of carbon dioxide and nitrogen from natural gas.

In a preliminary report to the Ordnance Department of the War Department on the nitrogen industry by Charles L. Parsons published in the *Journal of Industrial and Engineering Chemistry* of September, 1917, pages 833 to 841, will be found a discussion of the methods utilized for the production of nitric acid and ammonia from the nitrogen of the air. Three of these processes — the Haber Process, the Cyanamid Process and the Cyanide Process, all require practically pure atmospheric nitrogen.

The Haber process is a German one and consists of taking hydrogen and nitrogen and causing them to undergo chemical change at a temperature of about 500° C. and at pressures from 125 to 150 atmospheres to form ammonia. This process is the one now mainly used in Germany. During the year 1917 the output by this process was equivalent to about 500,000 tons of ammonium sulphate. The ammonia obtained by this process can be oxidized and converted into nitric acid.

The cyanamid process is used quite extensively in both Europe and America. This process consists of heating calcium carbide to a red heat in the presence of nitrogen. The cyanamid produced is then powdered and mixed with sodium carbonate and lime and the mixture treated with steam in large autoclaves to convert the nitrogen of the cyanamid into ammonia. In 1917 the German production of cyanamid was approximately 400,000 tons. Cyanamid is not only useful as a source of ammonia and ammonium compounds but is well suited for use as a fertilizer when applied directly to the soil.

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The cyanide process is, up to the present time, not a commercial success. The process consists of heating a mixture of sodium carbonate, ground coke or carbon in contact with finely divided iron to redness and then passing nitrogen through the mass. A reaction takes place rapidly resulting in the formation of sodium cyanide.

It will be seen from the above that the nitrogen contained in the discharge gases from gas engines has many chemical possibilities in the production of compounds which are industrially very important.

Argon and the rare or noble gases, on account of the fact that these substances undergo no chemical change of any kind will certainly be left in the residue gas after the recovery of carbon dioxide and the fixation of the nitrogen.

Raleigh was enabled to isolate argon and other rare gases from the atmosphere in 1893 by making use of the chemical inertia of these substances. Argon is a gas without color, taste or smell. It is incombustible and a non-supporter of combustion. Recently it has been shown that argon may find extensive use in the electric bulb industry.

The dawn of the day of the American industrial empire is upon us, and as the light of it breaks, the most splendid possibilities are revealed to us. In no field of commercial endeavor are its possibilities greater than in the industries having specifically to do with oil and gas. There are the possibilities of food for mankind and heat to prepare it for his growth and development. There is medicine to cure his ills and drown his sorrows; light to illumine his pathway and make it more cheery; materials to clothe, adorn and glorify the bodies of men. It is a most auspicious and prophetic time and one which is worthy of the most serious and thoughtful consideration. It is the time above all times when men of vision and men of courage are needed. It is not an impossible time, but is one where the greatest of results may be realized if the efforts are properly directed. Subsidized chemical and engineering research is the keynote to the commercial realization of the possibilities of this age. The

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Natural Gas Men's Association can do its bit by entering upon a program of subsidized and heartily supported research.

At the conclusion of his prepared address Dr. Garner said:

In closing, from the chemist's viewpoint, I believe that this is the most remarkable period of American industry. As chemists we have always been taught heretofore to look to the East — to Germany — for inspiration. What we were not doing we always contented ourselves with stating the German was doing. But what of the situation today? We have reached a place right now where American chemistry is going to be the leader in the world; (great applause) and if the American chemistry is going to lead the world it must lead American industry as German chemistry has lead German industry. American chemistry, therefore, must have the support of American industry to realize this goal and you can see from a perusal of the meetings of the Chemical Societies throughout the country that the American chemist is alert to his opportunities and he is going to be on the job. We are certainly going to do everything that Germany has ever done and we are going to do it in a better way (long continued applause). I think that the campaign of American supremacy, scientific and industrial, can be started by The Natural Gas Association of America authorizing the appointment of a Committee to collect all of the information that is available for the future of the industry along these lines. I thank you very kindly, gentlemen. (Great applause.)

By way of concluding I wish to say — at the suggestion of President Guffey — that we will be glad to open our laboratories in the Mellon Institute so that if any of you desire to visit it you can do so. I have not consulted the Mellon Institute authorities about this but I feel it will be entirely proper for you to visit certain portions of the laboratory where there are many things going on in the way of chemical research that would be of great value to you. However, I want to call your attention to the fact that in the Mellon Institute today we have about thirty-five different corporations represented in research work and in addition to that we are doing a lot of secret work for the United

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States Government. It is, therefore, apparent why they would not want many people from the outside at this particular time but if you will agree that you will go only to my laboratory and to such other places as I will indicate I will be only too glad to extend the invitation to you and to assume all responsibility in the matter notwithstanding the fact that I have not presented it to the authorities. Those of you who desire to go will be cordially welcome at Room 214, Mellon Institute and I will have assigned a couple of my assistants who will be glad to show and explain to you any matters which may be of interest to you. They will welcome you and do what they can to make your visit a profitable one. There will be quite a considerable section of the laboratories open for your inspection including the lecture rooms, machine shops and various other departments where work of a secret nature is not being conducted. An interesting department which we will be glad to show you is that of The Ward Baking Company. The Ward Baking Company has three men out there working continually in the development of a new process for their product. A number of other companies have Fellowships but it is not necessary to name them at this time. I will make arrangements for any of you who so desire to visit the Mellon Institute this afternoon at any time after one o'clock, say between one and five o'clock. Those arrangements will be made by me as soon as I leave the building so that those of you who desire to come between those hours will be cordially welcomed and the freedom of those portions of the Institute will be turned over to you for your inspection and edification.

PRESIDENT GUFFEY: Gentlemen, I am sure we are all indebted to Dr. Garner for this very instructive paper and address. The matter is now open for discussion. I do not know whether there are any technical engineers members of the Association who care to discuss this paper at this time. Without the formality of a motion, however, I desire to extend to Dr. Garner on behalf of the membership of The Natural Gas Association of America our hearty thanks for this most excellent contribution to natural gas literature and to say to him for you that in the efforts of Dr. Garner and of other eminent chemists to make American chem-

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istry the leader of the world we all join in wishing you a speedy realization of your hopes and desires.

If there is no further discussion we will now proceed to receive the reports of the standing committees.

The first report is the report on Uniform Accounting. I will ask Mr. Jones to read it.

Secretary Jones then read the following:

REPORT OF COMMITTEE ON UNIFORM ACCOUNTING.

"Your Committee begs to report that during the past year we have had several conferences on the subject of the adoption of a uniform classification of accounting, and have agreed upon the main essentials. We have arranged with the Public Service Commissions of Pennsylvania, West Virginia, Ohio and New York that this classification will be submitted to them for their consideration, and have every reason to believe that within a comparatively short time we will be called into consultation with the representatives of the different commissions.

"Your committee was represented at a meeting with the Publice Service Commission of Pennsylvania on the subject of uniform deposits, but as yet no rule has been issued by the Commission on this subject.

"Respectfully submitted,

"C. S. MITCHELL, *Vice Chairman.*"

PRESIDENT GUFFEY: If there are no objections to the report as read it will be received and filed as a part of the minutes of the meeting.

The next report is the report of the Committee on Gas Conservation. Mr. A. J. Diescher is Chairman. Is he present? If not I understand that Dr. I. C. White, a member of the Committee, has a copy of the report with him and I will ask him to submit it for the Committee.

DR. I. C. WHITE: Mr. President, and Gentlemen:

Mr. Diescher handed me a copy of the report yesterday evening to look over and to make suggestions. I assumed, of

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course, that he would be here to read it today. You do not see him do you, Mr. Chairman?

PRESIDENT GUFFEY: No, I understand he is not present and therefore we will ask you to present the report of the Committee.

DR. I. C. WHITE: Then in his absence I will read it for him. This is Mr. Diescher's report.

And thereupon Dr. White read the following:

REPORT OF COMMITTEE ON GAS CONSERVATION.

Since our last convention there has been a general improvement in gas conservation matters. Operators for oil and gas have taken a greater interest in preventing waste and sealing off the gas sands through which they drill.

Several flagrant wastages of gas occurred during the year, principally in Northern Texas and in the Elm Grove field of Louisiana. In the former case the wastage was voluntary while in the latter it was accidental and every effort was made to close in the well which had broken loose.

In Northern Texas, wells of five to ten million feet open flow of gas are allowed to blow to carry the oil to the surface, although the gas sand is several hundred feet above the oil sand. There are no laws in Texas prohibiting waste and for the present it is strictly a matter of the operator's conscience whether he will protect the gas or not.

The use of casing-head gas for gasoline manufacture has tended greatly toward a better attitude generally, respecting conservation. The amount of casing head gas wasting, while greatly reduced over past years, is still a very great item. It is estimated in West Virginia there are over one hundred million cubic feet blowing to the air daily. There is no doubt as much gas going to waste from this source in Oklahoma and other States. While it is not gas which would be available for entering a gas trunk line without compression it has its bearing upon general natural gas conservation.

In Osage County, Oklahoma, there has been a waste of about two billion feet of gas during the past year from one

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lease which was of high rock pressure, four hundred pounds, during a controversy whether it was or was not casing-head gas. Other than this, Oklahoma is practically free from high pressure gas blowing to the air. The Oklahoma authorities have greatly extended and improved their regulation of conservation and have won the good will and regard of oil and gas operators. Their work stands out as an example of what can be done through governmental conservation regulation, and is a good guide for other States to follow.

Perhaps the best example of gas and oil conservation in the United States today is on the property of the Standard Oil Company of California at Fullerton, Cal., where they are producing large volumes of oil and gas in the same sand, separating the gas and oil at the surface, absorbing the gasoline from the oil, and recovering all of the oil, gas, and gasoline from their property without waste. The oil and gasoline are run into the oil lines to the refineries and the gas is sold to the pipelines supplying the Southern California markets. These wells produce up to several thousand barrels of oil daily and ten to twenty million feet of gas. Their installation plant stands out as an example of what can be done to eliminate waste on an operating property.

Embodied in this report is a general resume of the natural gas conservation laws and regulations of the different States.

In general, it pleases the committee to be able to report that a considerable advance is being made toward effective natural gas conservation over the land, both through regulation and through the sentiment of the operators.

A. J. DIESCHER,
Chairman.

After reading the above report Dr. I. C. White said:

After the illuminating address we had from Dr. Garner this morning concerning the enormous potential value locked up in natural gas which none of us have ever sufficiently realized, the increasing importance of conservation of this natural product becomes more and more imperative.

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You will remember that I like one flying in the wilderness down in West Virginia have been putting forth my feeble efforts and raising my feeble voice against this enormous waste of one of our most valuable natural products for over twenty years. It has never met with legislative approval. Not a single line has been written into the Statutes of West Virginia like there has been in Oklahoma where Mr. Diescher, connected with one of the great oil and gas companies, says that their Governmental regulations are working splendidly and that the natural gas and oil companies are satisfied with it. Now why can we not have these same Governmental regulations in Pennsylvania and West Virginia? The vast amount of gas left in these old wells is much more valuable now than it ever was before and these wonderful by-products which Dr. Garner has told us about in such an illuminating way and in such a way that even the layman can realize their importance making it all the more imperative to see to it that the waste in natural gas be stopped and stopped quickly. The enormous waste that has been permitted in these two States, or these three States I may say, Pennsylvania, West Virginia and Ohio must astound the ordinary gas and oil producer when brought face to face with the commercial value of the product thus wasted.

Now why cannot these larger operating companies, like the South Penn Oil Company. The Manufacturers Company, The Philadelphia Company and the other larger operating companies, — why can they not inaugurate a plan like the Standard Oil Company of California has done in that field? They can afford to pay the independent operator who does not have enough gas to warrant installation, — they can afford to pay him a reasonable price for this gas that would otherwise be wasted. The independent operators would be glad to sell it to them. Let these larger companies establish plants to take care of this waste and to utilize it. As Dr. Garner has shown us this morning it can still be utilized with b. t. u. of over 800 to the cubic foot. It is a much better gas than you can manufacture from coal. Dr. Garner has demonstrated to you this morning the value of the by-products to be obtained from that gas so that even the remnants may be utilized advantageously in

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a commercial way. The citizens of these States would be glad to have that kind of gas for fuel which would aid materially in supplying the demand of natural gas for domestic purposes. These larger companies can well afford to put in these installations and work out these problems that Dr. Garner has been so successfully attacking and before this Association meets again in Annual Session I hope to see these great companies which are doing so much in a patriotic way, take up this question of waste in a serious manner and in a serious way and with the funds that they have at their disposal they will not only reap large returns for themselves but save and conserve one of the best natural products in the world full of these potential possibilities and save it for themselves and for the country. I thank you.

PRESIDENT GUFFEY: I am sure we all appreciate the seriousness of the suggestion made by Dr. White and appreciate as well the report of the Conservation Committee just read by him. If there are no objections the report of the Conservation Committee will be received, ordered placed on file and spread upon the minutes.

The next report is the report of the Committee on Constitution and By-Laws of which Mr. Hoover is Chairman.

Mr. H. J. Hoover then submitted the following:

REPORT OF THE COMMITTEE ON CONSTITUTION AND BY-LAWS.

Mr. President and Gentlemen:—

The Committee appointed last year to revise the Constitution and By-Laws of The Natural Gas Association of America begs leave to submit a number of changes in the present Constitution and also the By-Laws.

According to the Constitution the Constitution cannot be changed at this meeting.

Article 8, Sec. 1, reads:

"Any proposition to amend this Constitution shall be submitted at a regular meeting, and secondly by a majority of all the members present;

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the proposition shall not be acted upon until the next regular meeting, when if approved by two-thirds of all the members who may be present at said meeting, it shall become a part of the Constitution."

The recommendation of the Committee is that the Constitution as proposed to be revised and amended, be printed some time after this meeting, submitted to all the members of the Association, to be acted upon at the next Annual Meeting.

If it is deemed advisable to go through the Constitution and read the proposed amendments at this time I will do so but as it cannot be adopted until the next Annual Meeting I think it would be much better to have it submitted to each member in printed form so that the changes may be noted and the matter can come up then at the next meeting at which time each member will have before him the Constitution as it is now and the amendments and revisions as proposed by the Committee.

These portions of the Constitution as at present in effect and the same portions of the Constitution as proposed to be revised and amended as per the recommendation of the Committee are as follows:

Sec. 1 of Article 3 of the Constitution as in effect at this time:

"The membership of the Association shall consist of Honorary, Active and Junior Members, and the Junior Members shall not be entitled to vote nor hold office, but shall be entitled to all the other privileges of membership."

Sec. 1 of Article 3 as amended, per recommendation of the Committee:

"SEC. 1. The membership of the Association shall consist of Honorary, Associate and Active members, and the Honorary and Associate members shall not be entitled to vote nor hold office, but shall be entitled to all the other privileges of membership."

Sec. 4 of Article 3 of the Constitution as in effect at this time:

"SEC. 4. To be eligible to Junior Membership, a person must be directly or indirectly connected with the gas industry, or may be skilled

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therein. Junior members shall have all the privileges and courtesies of the Association, except the right to vote or hold office. Junior members may be transferred to Active Membership by a vote of the Association upon recommendation of the Board of Directors."

Sec. 4 of Article 3 as amended per recommendation of Committee:

"SEC. 4. Any corporation, firm or partnership engaged in the production, transportation or distribution of natural gas may become an associate member without voting power, upon payment of such dues as may be prescribed by the Board of Directors of the Association."

Sec. 1 and Sec. 2 of Article 4 of the Constitution as in effect at this time:

"SEC. 1. The officers of the Association shall consist of a President, Vice President and Secretary-Treasurer, who shall be elected for one year.

"SEC. 2. The Board of Directors shall consist of the President, the Vice President, the Secretary-Treasurer and twelve active members of the Association, six of whom shall be elected at each annual meeting, and whose term of office shall be two years. Five members of the Board of Directors shall constitute a quorum for the transaction of business.

"At the annual meeting in 1913, there shall be elected six Directors, who will serve two years, and four Directors who shall serve one year."

Sec. 1 and Sec. 2 of Article 4 as amended per recommendation of Committee:

"SEC. 1. The officers of the Association shall consist of a President, three Vice Presidents and Secretary and Treasurer, who shall be elected for one year.

"SEC. 2. The Board of Directors shall consist of the President, Vice President and twelve active members of the Association, six of whom shall be elected at each annual meeting, and whose term of office shall be two years. Seven members of the Board of Directors shall constitute a quorum for the transaction of business."

Article 5, Sec. 1, Sec. 2 and Sec. 3 of the Constitution as in effect at this time:

"SEC. 1. The management of the Affairs of the Association shall be intrusted to the officers and the Board of Directors, under the general direction of the members in convention.

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"SEC. 2. A majority of the Board shall constitute a quorum, and the Board shall have the power to fill any vacancies that may exist therein.

"SEC. 3. That the Past Presidents of the Association be constituted an Advisory Committee, which, from time to time, shall give to the Association wise counsel and sound advice on matters of importance. Three members of this Committee shall constitute a quorum for the transaction of business.

"The Chairman of this Committee shall be each out-going president."

Sec. 1 and Sec. 2 of Article 5 as amended per recommendation of Committee:

"SEC. 1. The management of the affairs of the Association shall be intrusted to the officers and the Board of Directors, under the general direction of the members in convention. The Board shall have the power to fill any vacancies that may exist therein.

"SEC. 2. That the Past Presidents of the Association be constituted an Advisory Committee which from time to time, shall give to the Association wise counsel and sound advice on matters of importance. Three members of this Committee shall constitute a quorum for the transaction of business.

"The Chairman of this Committee shall be each out-going president."

MR. HOOVER (continuing): The provision of the By-Laws with reference to revision or amendment now in effect being Sec. 1 and Sec. 2 of Article 13 is as follows:

"These by-laws may be altered or amended only in the following manner:

"SEC. 1. Any proposition to alter or repeal an existing By-Law, shall be presented in writing during any meeting of the Association, at any time before its adjournment, seconded by not less than three members, shall be read twice, and if approved by two-thirds of all the members present, shall become a part of these By-Laws; but no such alteration or amendment shall affect any question pending at the time of its adoption.

"SEC. 2. Any additional section of these By-Laws, not in conflict with existing By-Laws, may be adopted at any meeting of the Association, upon being presented in writing, duly seconded, read twice, and approved by at least two-thirds of all the members present."

There are three changes recommended in the By-Laws which the Committee submits to be acted upon at this meeting:

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The first is in Article 4, Sec. 2 with reference to the duties of the Secretary-Treasurer.

The second is in Article 6, Sec. 4 with reference to the duties of the Board of Directors in regard to the selection of a Finance Committee of three.

The third is in Article 6, Sec. 6 with reference to the Appointment of a Nominating Committee.

I will read those portions of the By-Laws as in effect at the present time and in conjunction therewith I will read the recommendations of the Committee as to the amendment and revision of those particular sections.

Sec. 2 of Article 4 of the By-Laws as in effect at this time reads as follows:

"SEC. 2. The Secretary-Treasurer shall attend all meetings of the Association and of the Board of Directors; shall have charge of the books, papers and other property of the Association and perform such other duties as may properly belong to his office."

Sec. 2 and Sec. 3 of Article 4 as amended per recommendation of the Committee read as follows:

"SEC. 2. The Secretary shall attend all meetings of the Association and of the Board of Directors; shall have charge of the books, papers and other property of the Association and perform such other duties as may properly belong to his office and be prescribed by the Board of Directors.

"SEC. 3. The Treasurer shall attend to the collection of dues from all members, shall have the custody of the funds of the Association, and shall keep the financial books of the Association, and disburse said funds in the manner prescribed by the Board of Directors."

Sec. 4 of Article 6 of the By-Laws as in effect at this time reads as follows:

"SEC. 4. Said Board shall annually, immediately after its own organization, elect a finance committee of three, from its own number who shall have power to examine at any time, the books and accounts of the Secretary-Treasurer; said committee shall also on the morning of the first day of the annual meeting, examine the report of the Secretary-Treasurer, audit his accounts, and report thereon to the Association, provided, that no officer whose accounts may be subject to examination shall under any circumstances, be a member of such examining com-

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mittee. The Board of Directors, at the same meeting, shall also appoint a committee of three from its own number, whose duty it shall be to examine and report on applications for membership."

Sec. 4 of Article 6 as amended per recommendation of the Committee reads as follows:

"SEC. 4. Said Board shall annually, immediately after its own organization, elect a finance committee of three, from its own number who shall examine the books and accounts of the Secretary and Treasurer, the report of the Secretary and Treasurer, audit the accounts, and report thereon to the Association, provided that; no officer whose accounts may be subject to examination shall under any circumstances, be a member of such examining committee. The Board of Directors, at the same meeting, shall also appoint a committee of three from its own number, whose duty it shall be to examine and report on applications for membership."

After Sec. 5 of Article 6 your Committee recommends the adoption of an additional section numbered Section 6 which reads as follows:

"SEC. 6. The Board of Directors shall at the last meeting previous to the annual convention, appoint a nominating committee of three members of the association."

In the By-Laws as in effect at this time there is no provision for appointing a Nominating Committee except by the President and it was deemed advisable to have that Committee appointed by the Board of Directors.

Those three amendments to the By-Laws we suggest be adopted at this meeting. The changes in the Constitution and any other changes in the By-Laws we suggest be printed and adopted or rejected at the next annual meeting.

Now if it be deemed advisable to act upon these three changes in the By-Laws I would recommend as a part of the report of the Committee on Constitution and By-Laws that that be acted upon at this meeting.

PRESIDENT GUFFEY: I think we ought to entertain a motion to that effect that the changes as recommended in the By-Laws

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be adopted at this meeting as the By-Laws provide for amendments in this way.

MR. H. J. HOOVER: I offer the motion Mr. President that the By-Laws be amended as recommended by the report of the Committee on Constitution and By-Laws. The By-Laws as in effect have been read in your hearing and the amendments recommended by the Committee have been read in your hearing and I now move that the By-Laws be amended as recommended and as read.

MR. L. B. DENNING: I second the motion of Mr. Hoover.

The above motion having been duly seconded was then unanimously adopted.

PRESIDENT GUFFEY: The amendments as recommended by the Committee are ordered made. I will now entertain a motion that the Constitution as recommended to be revised and amended and the By-Laws as amended be printed and a copy mailed to every member of the Association so that we can get the matter intelligently before you at our next Annual Meeting. Do I hear such a motion?

MR. DONALD MCDONALD: I will make that motion Mr. President.

DR. I. C. WHITE: I second the motion.

The above motion having been duly seconded was then unanimously adopted.

PRESIDENT GUFFEY: If there are no objections the report of the Committee on Constitution and By-Laws may then be considered as received, ordered placed on file and spread upon the minutes.

The next order of business is a paper by Charles V. Critchfield on the subject of "The Value of Gas Delivered at Varying Pressures." (Applause.)

Mr. Charles V. Critchfield, Gas Engineer, Public Utilities Commission of Ohio, then said:

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Mr. President and Gentlemen:—

Before formally presenting this paper I wish to take the opportunity of thanking Mr. W. Y. Cartwright in the presence of this assembly for the use of the very complete laboratory which the Union Gas and Electric Company possesses in the City of Cincinnati and also to acknowledge the many helpful suggestions that have come from several members of the Association.

Mr. Charles V. Critchfield then read the following paper:

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THE VALUE OF GAS DELIVERED AT VARYING PRESSURES.

By Charles V. Critchfield.

Mr. President and Gentlemen of the Association:

In response to your invitation to prepare a paper on the subject of "The Value of Gas Delivered at Varying Pressures" I have in mind the fact that the published records of this meeting may reach many consumers of companies whose representatives are present here today and, therefore, I am treating the subject, as far as possible, in terms and words readily understood by all rather than those I would probably use in addressing you who are so familiar with the subject. In so doing I trust you will overlook many statements and descriptions which I know to you, gentlemen, will be most trite and commonplace.

With this apology I will proceed to describe some familiar devices in order that any reader of this paper unfamiliar with the apparatus employed in my experiments may more readily understand their purpose and use.

METER PROVERS.

A meter prover is a device which has been accepted by the Federal and State authorities as the standard instrument by which the degree of accuracy of domestic gas meters is ascertained.

The accuracy of the prover in turn is determined by a cubic foot, usually called a cubic foot bottle, which is a very simple device, being nothing more than a metallic bottle holding a cubic foot of water and having a neck at both top and bottom. As the bottle is filled with water it displaces a cubic foot of air or gas, or the process may be reversed by allowing the bottle full of water to empty, thereby drawing in a cubic foot of air or gas. In Ohio it was formerly the custom to have provers tested at the State Capitol but, of late years, all provers are

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tested at the locations where they will be used. In other words, the bottle is taken to the prover rather than the prover to the bottle, a much better method.

The meter prover consists of two metal tanks, each with one open end. One tank is set on legs in an upward position, the other tank is inverted and suspended by a supporting chain. This inverted tank or "bell", as it is more properly termed, being of smaller diameter, will pass down inside the lower tank, which holds sufficient water to form a movable bottom to the upper tank or bell. The bell serves the purpose of a gas container and the amount of gas contained varies as the position of the bell is raised or submerged. Provers are built in sizes to hold five, ten, and twenty cubic feet of gas. There have been manufactured some holding twenty-five cubic feet. The chain by which the bell is supported, heretofore mentioned, passes over a large balance wheel supported by three columns resting on the lower tank. On the other end of the chain is a weight holder with weights to support the bell. In testing domestic gas meters sufficient weights are used to almost counterbalance the bell but still permit the bell to force its contents of gas out of the prover under a slight pressure. To the axis of the balance wheel just mentioned is attached an involute with a counterpoise weight, for the purpose of counteracting the buoying effect of the water on the bell as it is raised or submerged. Gas is drawn into the bell through an inlet and expelled through an outlet. Both inlet and outlet are controlled by valves.

On either the bell or one of the columns supporting the balance wheel is a scale graduated in cubic feet and fractions of a foot. The manner of testing an ordinary meter is as follows:

After the inlet side of the prover is connected to the source of gas supply and the outlet side connected to the inlet side of the gas meter with the outlet prover valve closed and the inlet prover valve opened, the bell is slowly raised by hand and, as it rises, gas flows into the bell. When the scale shows a given number of feet of gas within the bell, the inlet valve is closed, the position of a small proving hand on the meter index being carefully noted. The outlet from the outlet prover cock is opened, permitting gas to flow out of the prover through the meter. When-

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ever, say, 5 feet of gas has passed, as indicated by the scale on the prover, the outlet valves quickly closed and, if the index hand on the meter registers 5 feet as having passed through the meter, the test would indicate an accurate meter. If the meter index hand shows less than 5 feet a slow meter is indicated. If it shows more than 5 feet a fast meter is indicated. As gas expands when heated and contracts when chilled, great care must be taken to have the temperature of the water in the prover which comes in contact with the gas and that of the room in which the test is made the same, and both as nearly 60 degrees F. as possible. By reason of the fact that gas meters are located both outdoors and indoors, our Code in Ohio permits a variation of 3% fast or slow as an accurate meter.

CALORIMETER

A calorimeter is an instrument used to determine the amount of heat which will be produced by the combustion taking place in a flame of combined gas and air as it takes place in the burners of gas appliances, such as kitchen ranges, furnaces, hot water heaters, and heating devices. While a calorimeter to one unaccustomed to its operation seems a complicated device, in reality it is a very simple instrument, in fact nothing more than a refined instantaneous water heater equipped with some very sensitive thermometers, a very accurate gas meter and equally accurate weighing scales. The value of the results obtained depend largely on a quick eye and a steady hand rather than a mind trained by intricate mathematical problems.

There are several types of calorimeter in use, one of which consists of a small wet meter, a small governor to secure a steady flow of gas, the calorimeter proper, a set of scales, two copper water pails, and a number of short lengths of rubber tubing. Named in the order of the gas travel comes first the governor, which is in construction a miniature prover, automatic in action, with the bell weighted to give the desired pressure and having its inlet connected by a small rubber tubing to the gas supply and its outlet similarly connected to the small meter. This type of meter differs essentially from the ordinary meter in that a drum, made up of several compartments, revolving par-

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tially submerged in water, takes the duty performed by leather diaphragms in the commercial meter. If you will permit me to digress at this point I will relate an incident while amusing yet has its serious side as indicating the lack of information on the part of the general public regarding meters.

Possibly three years ago the Ohio Utilities Commission received a communication from a mayor of a small town in the northern part of Ohio. This communication was referred to me for investigation. The communication in substance stated that at the last session of the Village Council there was a discussion with relation to what sort of meters should be used in the village. It has been discovered during the winter season that there was a certain amount of moisture left on the walls and the window panes by the burning of gas and the conclusion was reached that the gas must be very wet and the inquiry was whether it would not be the proper thing to replace the dry meters that were then in the town with wet meters so that they would properly handle the wet gas that the Company was serving. (Laughter.) The outlet of the meter is connected by flexible tubing to the gas burner located at the bottom and within the calorimeter. The calorimeter proper is a hollow cylinder so constructed that water may readily flow around a central passage through which the heat from the burner passes. A thin wall separates the water from the warm air within and, consequently, rapidly absorbs whatever heat that is transmitted to the air by the gas burner. The temperature of the cold water entering the calorimeter is indicated by one thermometer and, as it passes out, by a second, indicating the temperature to which the gas flame has raised it during its travel through the calorimeter. As the water leaves it is caught in one of the copper pails and accurately weighed. Usually the amount of water used in each test is whatever will flow through the calorimeter while the burner is consuming 1/10 feet of gas. Ten runs, or tests, are made to give an average of 1 cubic foot.

Three factors enter into the test, viz., a cubic foot of gas measured by the meter, the weight of the water, and the difference in temperatures of the water as it enters and leaves the calorimeter. The product of these three, with some slight modifications, determines the amount of heat contained in a cubic foot

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of the gas burned, so by the use of this instrument the comparative heating values of various natural and artificial gases for domestic and industrial purposes can be very accurately ascertained.

REGULATORS

A gas regulator is a device both to reduce and maintain a regular gas pressure. A familiar form operates upon the same principle, to use an illustration familiar to all, of the lever and the fulcrum. If a bar of steel is laid across a small solid substance, which we will call the fulcrum, in such a way that the fulcrum divides the length of the bar unequally, we know that a small downward pressure on the long end of the bar will exert a very considerable upward pressure on the small end of the bar. In a gas regulator the low pressure gas, after it has passed through the regulator, exerts a back pressure on a large movable surface called a diaphragm, sufficient to equal the force of high pressure gas on a much smaller surface, called a valve. The object in using regulators is the necessity to reduce the pressure of gas as it issues from wells or long pipe lines to an extent that will permit the use of gas with safety in appliances in the homes.

DOMESTIC METER

The ordinary gas meter is a device for measuring and registering gas passing from the gas main into the consumer's premises. While men and women are familiar with the outside appearance of the ordinary domestic meter with its tin or iron case and registering dials, few have any conception of its interior mechanism and a brief description may be of interest to the reader.

I will describe the older and more familiar make known as the case diaphragm type. Within the tin body or case are two compartments, a large lower and an upper and smaller compartment. The lower contains two leather diaphragms, the upper the valves, gears, and the "clock" or registering device. Each meter has two outside openings, otherwise it is gas tight. One of these openings admits gas from the street main into the meter, the other opening is the outlet through which gas passes from the meter into the house lines. The principle on which

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the meter operates is somewhat similar to that of another familiar device, viz., the blacksmith's bellows. As the blacksmith opens the bellows air is drawn in, and as he closes this huge leather bag, the air within is forced out into the forge. So in the meter, these two leather diaphragms take the place of two miniature bellows which alternately fill with gas from the main and, in turn, close, forcing the gas onward into the house pipes. The blacksmith's arm is the power operating the bellows at the forge, the pressure of the gas is the force operating the diaphragms. Certain arms and rods attached to these leather diaphragms project upwards into the upper compartment and connect to the valves and registering mechanism. As there are two diaphragms the flow of gas through the meter is continuous. As one of them fills, the other discharges and, through this cycle of expanding and contracting, the hands on the dials are propelled so that each time one of these little leather bellows empties its content of gas, the dial hand is moved a small degree.

These leather diaphragms must hold just so much gas and no more, otherwise they will either turn the dial hand too far or not far enough, consequently great care is used in making these diaphragms. In fact, the accuracy of the meter depends almost wholly on the size and pliability of these leather bags.

Since the creation of the Ohio Utilities Commission, six years ago, it has been a part of my duties to inspect and test many domestic meters and, taking into consideration the conditions under which meters operate, as they are exposed to the action of the gas within and heat, cold and moisture without, I can safely say the gas meter is the most reliable measuring apparatus made.

I have, in as simple language as possible, described the Meter Prover, Calorimeter, Regulator and Domestic Meter, all four of which were used in some simple experiments to determine to what extent pressure influences the value of natural gas to domestic consumers.

The natural phenomena of contraction and expansion of gas works a blessing on the one hand and a menace on the other. The fact that large quantities of gas may be compressed into small volumes permits its transportation over large distances and

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makes it possible for cities hundreds of miles removed from the source to be supplied with apparent ease. As this contraction of volume by compressing can be controlled at the will of the Utility, I use the term "blessing". But when the Utility releases in its distributing system this compressed gas, it loses control, and the other phenomenon of expansibility take place, limited in its action only by the joint use of the Utility's patrons. In other words the response of the gas confined in the mains to expand itself to a volume that will meet the simultaneous requirements of every consumer served, results in dissipating the pressure to such a degree as to impair the service to all.

Gas plays no favorites but goes wherever wide open valves welcome its expansive character. Nature abhors a vacuum and every foot of gas unrestricted tries to fulfill nature's law.

All gas consumers are interested in just two things — first, the results obtained in terms of heat, light or power; second, the amount (cost) of gas used in obtaining such results. With some the first is of major importance, with some the second — many both. But with all the public verdict for poor results and high cost is, universally, low pressure.

To return to the subject of the value of gas at varying pressures, I call attention to the following cut illustrating a simple, and I believe a reliable method of ascertaining by actual measurement the amount of expansion due to the reduction of pressure.

This view shows two 10 ft. meter provers rigidly connected by a short length of ¾ in. pipe. Prover No. 1 has its bell weighted to a pressure of 4 oz. per sq. in. Prover No. 2 has its bell weighted to a pressure of 1 oz. After thoroughly purging both the provers, No. 1 was filled with gas and then allowed to force its contents into Prover No. 2. As the scale of Prover No. 1 indicated a transfer of 8 cu. ft. of gas, the scale of Prover No. 2 indicated 8.125 cu. ft., or an expansion of 1.56%. To check this test the provers were reversed, i. e., the pressure on Prover No. 2 was increased to 4 oz. and that of No. 1 reduced to 1 oz., with the same results. It will be noted that the percentage of expansion runs very close to the theoretical value and I believe with refined instruments, the results would coincide.

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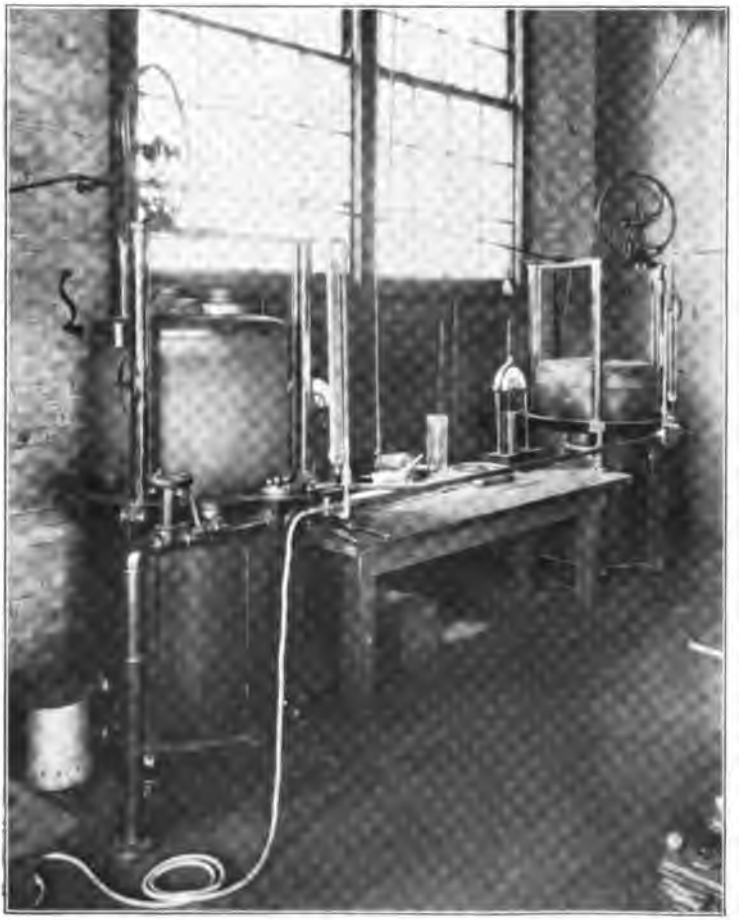
To make a similar demonstration, using domestic meters in place of provers, three meters were connected in series with some house regulators between. One was introduced into the first meter at 4 oz., reduced and passed into the second meter at 2 oz., and further reduced and passed through the third, or last, meter at 1 oz. The amount of gas registered in the third meter was 1½% more than by the first, while the difference between the first and second, and the second and third, was too slight to detect. The following view shows the arrangement of



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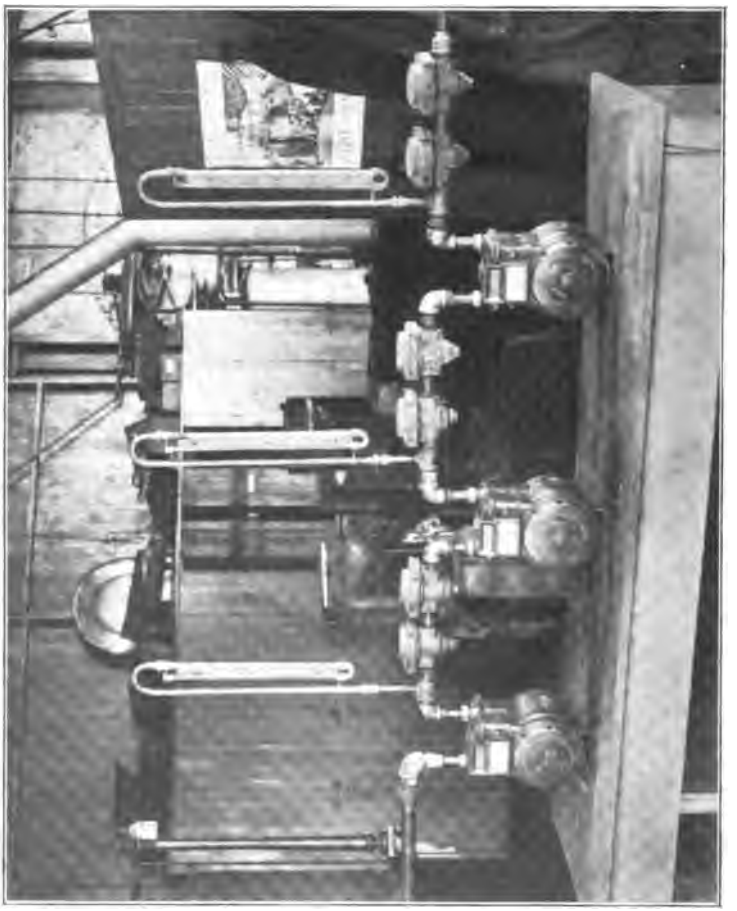
meters and regulators except that, in assembling them for the photographer, the regulators were inadvertently connected onto the outlet instead of the inlet sides of the meters.

A further demonstration of the degree of expansion as ex-



pressed in heat units was secured in repeated tests by the calorimeter with natural gas under 4 oz. and 1 oz. pressures. The loss in heat units when the pressure was reduced from 4 oz. to 1 oz. was so slight that it was covered up by the ordinary trivial errors made in the observations.

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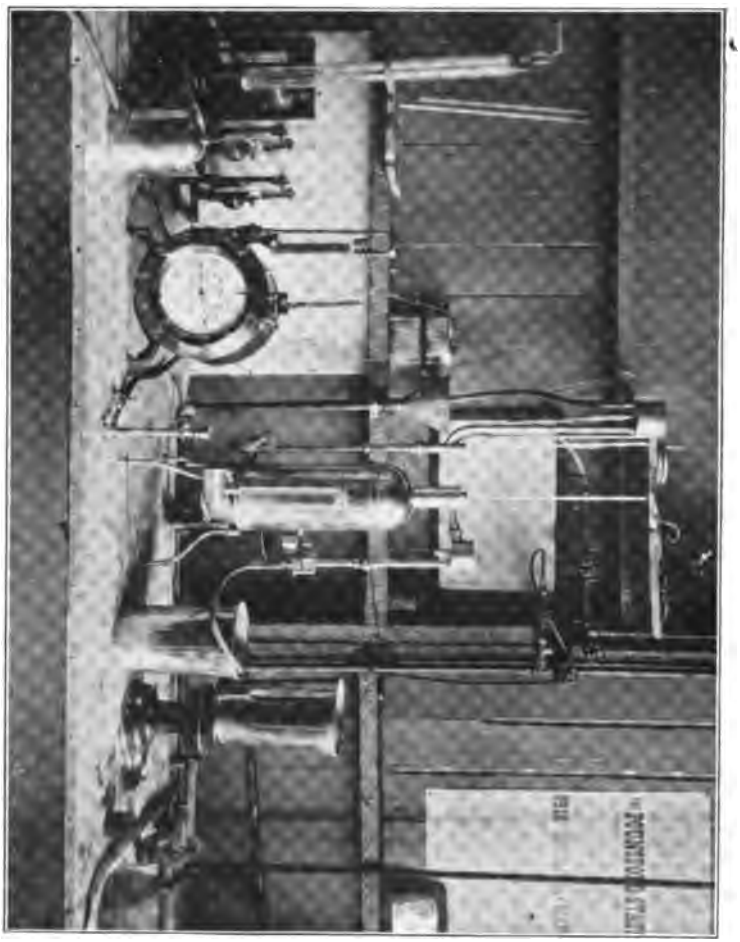
These three demonstrations prove conclusively that the amount of expansion following a lowering of pressures from 4 oz. to 1 oz. is very slight and, since domestic meters measure



This illustrates a typical calorimeter used in the experiment and heretofore described.

volumes irrespective of pressure, the increased amount of gas passing through and registered by meters at times when pressures are extremely low, is shown in the following table.

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Based upon 1,000 feet of gas delivered to the consumer under a pressure of 4 oz., meter would register an additional amount over 1,000 feet as follows:

Pressure	*Cu. ft.*
4 oz.	1,000
3½ "	1,002.1
3 "	1,004.3
2½ "	1,006.4
2 "	1,008.6
1½ "	1,010.7
1 "	1,012.9
½ "	1,015.1

Our experiments so far relate to the second item in which the consumer is interested, viz., the amount, or cost, of gas used. Passing to the first item, i. e., the results obtained in the appliances, our experiments relating to gas values at varying pressures would indicate that the unsatisfactory results of subnormal pressures are due, in the main, to appliances so inflexible that they operate efficiently, as well as economically, only at some predetermined pressure.

Two factors control the efficiency of the appliances. One has to do with the combustion, the other with the location where the combustion takes place. All domestic natural gas appliances are equipped with burners designed to produce what is known as a "Bunsen" flame. In order to burn natural gas efficiently it is necessary to support combustion by air. The quantity required is approximately ten parts of air to one of gas. In the usual form of burner gas is admitted through a central opening called an orifice, sometimes termed a "spud". Surrounding this orifice, which by the way has a diameter of a very small fraction of an inch, is a much larger passage through which the air enters the burner. Gas is forced through the orifice by a pressure and as it emerges it draws in a certain quantity of air which mixes with the gas and assists combustion. The air so drawn in is termed primary air. Additional air, called secondary air, originates around the flame, contributing to a more efficient combustion. The proportions of air to gas depend upon the relation

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of the gas orifice to the primary air passage at some known gas pressure.

The average gas consumer buys a kitchen range or hot-plate and puts it in service, assuming that the burners are complete and adjusted to efficiently consume every foot of gas furnished by the local gas company. To demonstrate what would happen to an average gas consumer, a two burner hot-plate was picked at random from the stock of a well-known manufacturer. This hot-plate was represented to be properly equipped and adjusted to efficiently burn natural gas furnished in a large city in Ohio on a pressure of 4 oz. The distance between the top of the burners and the top of the grid, or plate surface, was found to be 1⅛ in. and the burner was equipped with a No. 52 orifice and having the mixer shutter fully open. Connecting the hot-plate to the gas supply, natural gas of 1125 B. T. U., 6 pounds of water was placed in a new closed copper teakettle. A "well" had been previously soldered into the kettle into which was inserted a dairy thermometer. Test No. 1 shows the results obtained at from 1 oz. to 4 oz. pressures, with the burner as located by the manufacturer. Test No. 2 shows the results when the burner was lowered about 1 in. (⅞) in.)

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TEST NO. 1

Orifice	Weight Water	Burner Distance	Gas Pressure	Water Rise From	To	Net	Cubic Feet Gas	Time	
No. 52	6 lbs.	1⅛″	1 oz.	60 deg.	212 deg.	152 deg.	2.025	20′ 39″	381
"	6	1⅛″	2 oz.	55	212	157	2.17	14′ 52″	303
"	6	1⅛″	3 oz.	56	212	156	2.18	12′ 19″	251
"	6	1⅛″	4 oz.	56	212	156	2.30	11′ 18″	243

TEST NO. 2

Orifice	Weight Water	Burner Distance	Gas Pressure	Water Rise From	To	Net	Cubic Feet Gas	Time	
No. 52	6 lbs.	1¾″	1 oz.	60 deg.	212 deg.	152 deg.	2.20	22′ 20″	448
"	6	1¾″	2 oz.	58	212	154	2.37	16′ 39″	364
"	6	1¾″	3 oz.	56	212	154	2.475	13′ 47″	315
"	6	1¾″	4 oz.	54	212	158	2.48	11′ 46″	277

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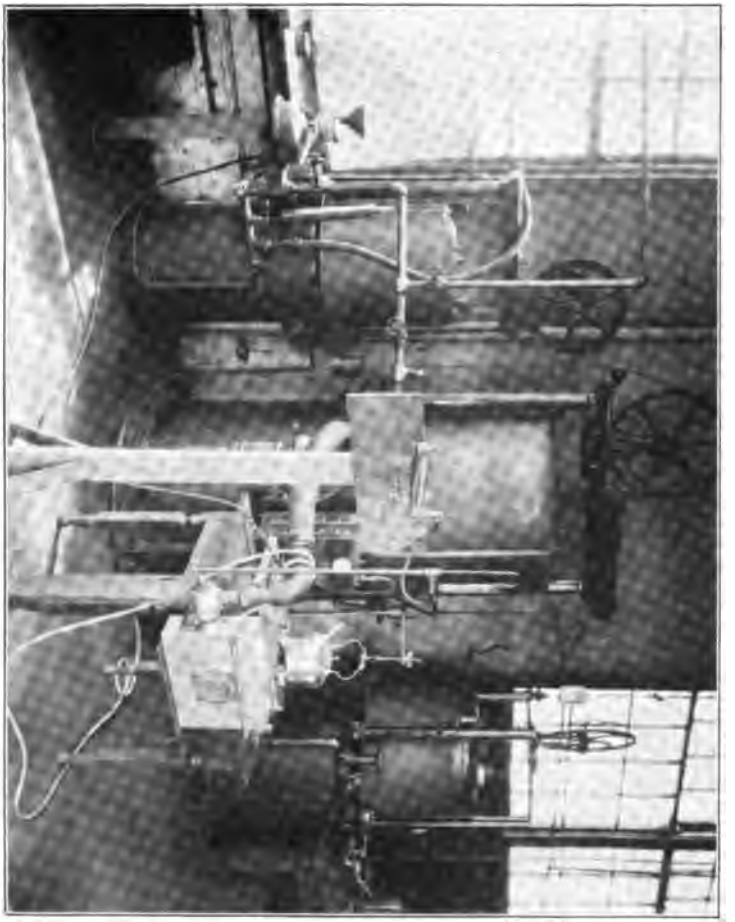
ADDENDA



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The figures in the last column to the right are merely for the purpose of ready comparison, being the product of the rise in temperature, the gas consumed and the time. Two things will be noticed, first the quantity of gas varies much less than the time; second, the distance of the burner from the vessel affects results much more than does the variation in pressure. In my opinion no appreciable loss through low pressures results to the consumer through meter registration, but considerable loss indirectly follows from a sluggish flow of gas and attendant poor mixers, combined with short burner flames. To state this briefly and more intelligently would be to describe a situation wherein all the gas companies' consumers would try to divide among themselves the available supply, say, one million feet, by a demand that required several hundred thousand more to give their appliances, unadjusted, a sufficient supply for efficient operation.

If I were to be asked what suggestions would you offer to meet this situation, it would be to lower your normal pressures as far as your distributing system would permit and maintain a stable pressure, adjust all appliances to this pressure; buy, borrow or steal all the gas you can; make no more extension; induce your customers to install combination heating appliances; educate your patrons to realize that the heyday of gas production is behind them and that certain inconveniences naturally go hand in hand with a cheap priced fuel.

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TIME PASSING ONE CUBIC FOOT NATURAL GAS THROUGH VARIOUS SIZE ORIFICES AT VARYING PRESSURES

	No.	60	58	56	52	48	46	44	42	40	38	34	30
	Diam.	.040	.042	.0465	.0635	.076	.081	.086	.0935	.098	.1015	.111	.1285
	Time	m s	m s	m s	m s	m s	m s	m s	m s	m s	m s	m s	m s
Pressure in ounces.	½	33	27 30	23 30	13 20	9 40	8 25	8 05	5 30	5 10	5 05	4 40	4 00
	1	21 55	19 40	15 50	8 15	7 20	4 55	4 45	3 50	3 40	3 35	3 25	2 45
	2	14 40	13 45	11 20	5 50	4 15	3 40	3 30	2 30	2 25	2 20	2 05	1 45
	4	10 50	10 00	8 45	3 55	3 05	2 45	2 35	1 50	1 45	1 40	1 35	1 05
	6	8 50	8 05	6 05	3 25	2 30	2 05	2 00	1 35	1 30	1 25	1 20	0 55

Room and Gas 60 degrees.
Meter — Harris Bros., Philadelphia.
Appliance — Hot-plate No. 32. Sawed burner, Estate Stove Co., Hamilton, Ohio.

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DISCUSSION.

PRESIDENT GUFFEY: We are certainly indebted to Mr. Critchfield for this able paper. The subject is now before you for discussion.

MR. J. F. MASON: Mr. President, I would like to ask Mr. Critchfield a question. What in your judgment is the proper normal pressure for a distributing system?

PRESIDENT GUFFEY: Did you hear the question Mr. Critchfield? If so I am sure we would all be glad to hear your answer to it.

MR. CHARLES V. CRITCHFIELD: That is a very difficult matter to say as it depends largely on your local distributing system.

In a general way I would say that rather than carry pressures of six or eight ounces during seventy-five per cent of the time and be obliged to drop to one, two or three ounces during the remainder of the time, it would be very much better to lower pressures to a point within your ability to maintain without fluctuation.

While it is not probably germane to a discussion of this paper, I would like to add a statement or two relative to the natural gas situation in Ohio. Very recently I said to the members of our State Commission that the burden of furnishing an adequate supply of gas had shifted very largely from the gas utilities to their consumers; that gas production had apparently reached a maximum and the problem now confronting the producer is to maintain the output while the consumer was morally bound by economical appliances and equitable distribution to keep within the available supply. Unless we have an open winter, there will be a repetition of the experiences of last. There are but two chief forms of fuel — i. e., coal and natural gas. The Federal Government will have full control of the distribution of coal and our Commission of gas. Every consumer in our state must have either gas or coal, and to my notion gas should always be used in preference to coal, since the latter can be stored and the former cannot, consequently it becomes the plain duty of every gas company to sell its maximum output every day in the month and every hour in the day and no regulatory body should

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issue orders so inflexible as to leave an undistributed surplus in the possession of any gas company where it could be substituted for coal.

MR. J. F. MASON: Assuming that the distributing plant is in normal condition and assuming that the necessities of the case required a lowering of the pressure in your judgment and from your research work, to what pressure would you recommend working down to?

MR. CRITCHFIELD: By the introduction of the proper kind of appliances, properly adjusted, I see no reason why natural gas cannot be distributed as low as two ounces.

MR. W. Y. CARTWRIGHT: Mr. Critchfield you might refer to your experience at my house last winter.

MR. CRITCHFIELD: Mr. Cartwright has asked me to tell you about what happened at his house. That reminds me of an incident. Mr. Cartwright has in his home a very efficient heating apparatus. I am not advertising any particular kind of heating apparatus but I believe his was made in the city of Cleveland. I know that during the intensely cold weather that prevailed in the country last winter I was in Cincinnati and examined the appartus in Mr. Cartwright's house which was working so efficiently that I found that Mr. Cartwright was able to keep his house warm on one-half inch of gas.

I think in the distribution of gas some poor results have been brought about through (I won't say lack of judgment because we all make mistakes) the practice usually followed when a Gas Company goes into a town and begins to pipe it and to lay services it naturally will lay a big service into the big house and a little service into the little house and when you get down to low pressure the fellow in the big house is getting the gas and the fellow in the little house is not getting it. He is being stinted in his supply. Although it is running contrary to usual practice yet I believe that if you increase the size of the service — I won't say anything about decreasing the size of the service to the big house but if you increase the size of the service to the small house you are going to get away from a great deal of your low pressure troubles and under those conditions I cannot understand why

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there will be any difficulty brought about by lowering pressures down to two ounces.

MR. HENRY C. MORRIS: Mr. President, I would like to ask Mr. Critchfield if in his judgment it is not going to be necessary for the gas range manufacturers to readjust their ranges because at the present time the distance between the top of the gas burner and the top of the grid is approximately two inches. With a four ounce pressure you can use the gas with comparative efficiency in a range constructed in that way but with a two ounce pressure I think it is going to be necessary to bring the cooking surface of the range closer to the burner and with gas ranges constructed as they are at the present time that cannot be done.

MR. CHARLES V. CRITCHFIELD: Oh, that is not a debatable question at all. The manufacturer of natural gas appliances must arrange to build and construct his appliances so as to meet this difficulty since the cooking surface must be brought closer to the flame. I used to burn artificial gas. In fact I used to manufacture artificial gas and later on began the use of natural gas. My wife always said to me she thought she could get quicker results on the old artificial range than she could get on the new natural gas range and this has been brought home to me for a good many years. The fact is that the burner in the natural gas range has been too far away from the top surface of the range. It might do in years gone by when we had all kinds of natural gas supply but when we are getting down now to the point where we are conserving the gas and using a lower pressure it is of course necessary that the appliances manufacturer should adjust himself to these changed conditions in the construction of his natural gas appliances.

MR.. J. C. MCDOWELL: Mr. President, from a practical point of view I think this paper of Mr. Critchfield's is one of the most valuable we have ever had presented to our Association for the reason that there is a very general impression among the consumers of gas that they are not getting half of the heat units out of the gas or half the heat out of the gas when they receive it at a lower pressure that they do at a higher pressure. This impression is so strongly imbedded in the public

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mind and it is so important that the true situation be brought to their attention that I do not think a gas company could do a wiser thing than to have this paper printed in the form in which it is now prepared for this convention and distributed among their consumers. It would do a world of good. Information is what the people want. They have been misinformed by demagogues because of their own naturally antagonistic feeling towards the gas meter and towards the gas man and they feel that they are being cheated in this way by the Gas Company. In fact many cities have raised this question and some Public Utilities Commissions have also labored under a similar misapprehension; one I know of particularly, attempted to enforce a higher pressure on the ground that there is not enough heat in the low pressure gas. So for that reason I am very much pleased to hear this paper and to have it presented to the members of this Association at this time.

Just one further suggestion on the matter of pressure. I will only take a moment. I know of two large installations which were installed and designed to distribute gas at a two ounce pressure and they gave a very fair service at that pressure. So that it is a question of design of your plant which is the practical point that must be given due consideration.

MR. L. N. DENNING: Mr. President, in line with Mr. Critchfield's statement that he thought that an artificial gas installation would give better results I may state that some experiments have recently been conducted — a series of them in fact, by the Ohio State University seeking to obtain comparative results by the use of an artificial gas stove taken out of stock and the ordinary natural gas range and hot plate. The experiments show that much better results were obtained from the use of the artificial gas stove than by either the natural gas range or the hot plate. I am informed that it is perfectly fair to conclude from the results of those experiments that anything above two ounces pressure in the use of natural gas is a waste both to the consumer and to the company.

Before this discussion is ended I would like Mr. Wyer to give the results of those experiments for the benefit of the members of the Association.

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MR. SAMUEL S. WYER: Mr. President, and Gentlemen: Some time ago in order to answer the question as to what is usable natural gas pressure, arrangements were made with the Department of Home Economics at the Ohio State University, Columbus, Ohio, to run a series of tests making cooking determination as to exactly what the gas consumed would be and what the time element would be and what the general efficiency of the apparatus would be in cooking potatoes by ordinary pan frying and boiling; in cooking meat by ordinary pan frying and pan broiling and in baking bread.

The first thing that was done was to follow the general viewpoint that usable conditions were more important than were efficiency. Therefore, a series of tests were conducted with the idea of translating — if we may use the expression — all of the engineering features into domestic science or home economics, in cooking operations. These tests have been completed. They have been published by the Ohio State University as a University Bulletin. Additional copies of that Bulletin can be obtained directly from the Department of Home Economics of the University.

The Bulletin is twenty-seven pages long and gives all the details of the tests which were carried on in demonstrating cooking operations from two-tenths of one ounce up to five ounce pressure using a standard natural gas range, a standard manufactured gas range and standard hot plate with no change whatever in adjustment.

In addition to giving the data pertaining to the test there is a general discussion of the fundamental principles underlying the whole natural gas pressure situation. In order that you may get a summary of the tests I will read the conclusion.

"1.—Satisfactory cooking operations in frying potatoes, boiling potatoes, frying beef steak, and pan broiling beef steak can be carried on with .2 oz. natural gas pressure.

"2—The changes in vessel position necessary to permit satisfactory operation at pressures as low as .2 oz. are easy to make and require no special changes in existing stoves.

"3.—Bread can be satisfactorily baked with .5 oz. natural gas pressure.

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"4.—Natural gas stoves are not properly constructed to use natural gas efficiently at high pressures, nor satisfactorily at low pressures.

"5.—At high pressures natural gas stoves are inefficient and therefore wasteful in their use of gas.

"6.—The burners on natural gas stoves are too low.

"7.—The holes in the spuds of natural gas stoves are too small.

"8.—Long flames for cooking operations are wasteful.

"9.—The maximum results are obtained with many short flames rather than a few long flames.

"10.—A strong draft of air may effect the flame away from cooking vessel so as to seriously interfere with and in many cases stop cooking.

"11.—Where two flames strike each other, due to the fact that openings are too close in burner, poor combustion will result. This will produce a luminous flame which will in turn result in a smoking burner. Neither air nor gas adjustment can overcome this.

"12.—Drilled burners are better than slotted burners, because there is less likelihood of two adjacent flames striking against each other, therefore producing imperfect combustion conditions.

"13.—Natural gas cook stoves should not be furnished with solid stove tops since this suggests the carrying on of cooking operations on top of the stove, rather than with the vessel in the proper position.

"14.—At low pressures no perceptible change can be made in the combustion conditions by adjusting the air shutter. The best conditions obtained were with the shutter wide open.

"15.—Too much heat is used in most cooking operations, correct application is more important than mere intensity.

"16.—The natural gas pressures carried in most natural gas distributing plants are too high for efficient operation.

"17.—Meter registration is approximately correct regardless as to variation in pressure. That is, meters do not run faster when the pressure is low.

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"18.—Lowering the temperature of natural gas increases its heating value per cubic foot. Natural gas has a temperature about 25 degrees lower in the coldest month in winter than in the hottest month in summer, and the heating value per cubic foot due to change in temperature is therefore about 5 per cent higher in the coldest month in winter than in the warmest month in summer.

"19.—The maximum possible variation of heating value due to variation in gage pressure would make the heating value during the low pressure periods in winter less than 3 per cent lower than during the high pressure period in summer.

"20.—Since the heating value increase due to low temperature of gas in winter more than offsets the possible decrease in heating value due to low pressure, the practical effect of the two is that the heating value per cubic foot of natural gas as served in the winter under low pressures and low temperature is higher than that served in the summer under higher pressures and higher temperature.

"21.—Variation in barometer from day to day may make more of a change in the heating value of gas than any possible variation in gage pressure.

"22.—Better and more efficient service could be rendered if natural gas pressures were generally lowered to probably 2 oz. rather than increased to 4 oz. or above.

"23.—The lowering of natural gas distributing pressures to approximately 2 oz. would produce more efficient and satisfactory operating conditions for the consumer, would greatly curtail the leakage on the consumer's premises, which is paid for by the consumer, and would also substantially lower the leakage in the gas company's distributing plant."

MR. DONALD MCDONALD: Mr. President, and Gentlemen: I differ fundamentally with the conclusions arrived at by Mr. Critchfield as to any benefit being derived by lowering our pressure. The largest part of our investment is in our distributing mains. If you divide the distributing pressure by four you cut down the quantity of gas, so that makes you carry about one-half. If you adjust your appliance to one inch and you only get a half inch then there is going to be dissatis-

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faction. If everybody in your city is adjusted down to one inch and all of them together take more gas than you can give, then your pressure is going to fall and nobody will be any better satisfied than he is now. But we should not start out by telling the public that it is our duty to lower our pressure because if it is our duty to lower our pressure it is also our duty to double the size of our distributing mains. That is a serious thing gentlemen and you are not accomplishing anything after you have done it. If I adjust a house so that it can be heated with a half ounce pressure just as Mr. Cartwright did then if everybody does that I cannot hold the half ounce pressure because at that half ounce pressure all the customers together are taking more gas than the company can furnish at that pressure and to remedy the difficulty we would be imposing on ourselves the duty of investing additional millions in mains when our customers will be no better off than before unless we can furnish them with the amount of gas they need. One customer has been used to putting three lumps of sugar in a cup of coffee. But suppose he cannot get but two lumps. He does not say the sugar is not as sweet as it was before. But he knows he has not got enough sugar. It is exactly the same way with gas. If he is accustomed to getting a hundred feet an hour and he can only get 50 feet an hour he don't get enough. He cannot do his cooking. He is not warm. Some of them are foolish enough to say that the gas is not as hot as it was and that they are paying for more than they can get.

Now let us correct these impressions which are wrong. But do not put another impression which is wrong and fundamentally mischievous by advocating the use of the gas at lower pressures because if we do we must make up our minds to either sell less gas or to provide larger mains.

MR. WILLIAM Y. CARTWRIGHT: Mr. President, I cannot agree with Mr. McDonald in his contention that a reduction of pressure would increase the consumption nor do I agree with his theory that it is necessary to increase the size of your mains. It is entirely possible to install individual regulators at home and utilize the gas that you have there at a lower pressure. The trouble with our distributing system at present is not so much in

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a shortage of gas as it is in the inefficient manner in which it is used.

In my residence this last winter I used gas at one-half of one inch pressure, so small an amount of natural gas that a man would hardly know what it would amount to. The man next door to me had his house about the same size. My temperatures for forty-five days were not below 70 degrees. The man next door never had over 45 degrees in his house during that time yet his gas bill was within $5.00 of what mine was. He used the same amount of gas but he did not get the proper efficiency out of it. We are advocating the installation of individual regulators and in Cincinnati we have one section where there are five thousand individual regulators and where we use mains to distribute the gas at 4, 5 and 6 ounces pressure. We have no trouble at all from that section of the City. Of course when the gas gives out it does not make any difference what installation you have but as long as there is any gas there that section of the city gets along very well during these extreme periods. But in sections of the city where we attempted to cut it down below 4 ounces they were almost as bad off as if they had no gas at all. I do not believe we are facing the possible problem of a reduction in this pressure. I believe it can be worked out. But each company by itself must consider its own individual problem. Something must be done as Mr. Critchfield has said to teach the consumer to properly utilize the gas which we are able to furnish to him. Of course there is not going to be enough to go around then but you are going to get a good deal farther with your problem than you will under the present situation.

A MEMBER: Mr. President, I wish you would call upon Mr. Weymouth to express himself on this subject.

PRESIDENT GUFFEY: We will be very glad to hear from Mr. Weymouth.

MR. WEYMOUTH: Mr. President, there is one point indicated in Mr. Critchfield's paper which was not emphasized which I would like to call attention to at this time and that is found on page 15 showing the results of certain tests that were made. The results of the tests were given but the efficiency is not stated. I have roughly worked out some figures while listening to the

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reading of the paper which indicate that the efficiency at 1 ounce in the first table is approximately 40 per cent and with 4 ounces it is approximately 35½ per cent.

In the second table the efficiency of 1 ounce is approximately 37 per cent and at 4 ounces it is 34 per cent. In other words as I have figured it at 1 ounce or the low pressure the efficiency is from 3 to 4½ per cent greater than it is at 4 ounces or to state it in another way you will get from 10 to 12 per cent more usable effect from your gas at the 1 ounce pressure than you would at the 4 ounce pressure.

Tests that we have made recently have confirmed the result that Mr. Wyer has outlined here today indicating that the best results are obtained at the low pressure of from one-half inch water up to 1 inch and a half of water and also that the height of utensils from the burner is one of the controlling features.

We also found that one of the great bugaboos of the gas man really should not exist for the reason that people are laboring under a misapprehension. It is very frequently stated that you cannot get an efficient mixture of air and gas throughout a range of pressure. We have found if you adjust your mixers to give efficient mixtures at from one-half ounce to one ounce pressure you will have a very perfect mixture throughout the higher ranges of pressure. In other words, if all the gas burning appliances were adjusted to the low pressure they would serve perfectly under the higher pressure that they might be subjected to.

I would also like to comment on the phase of the question that has come up in the statement made by Mr. McDonald and Mr. Cartwright. While it is true that at the lower pressure less gas could be delivered through the present distributing system nevertheless with the greater efficiency of utilization that could be effected by a proper education of the public and by so adjusting and changing their appliances there would be less gas demanded for the same needs. As Mr. Wyer has outlined the efficiency obtained in one of the standard appliances used very extensively was only about 13 per cent with 4 ounce pressure and I imagine from 13 to 18 per cent would represent fairly well the average efficiency obtained under these conditions whereas it is shown by Mr. Wyer's test and Mr. Critchfield's tests and tests of my

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own that efficiency of 37 to 45 per cent are very easily obtained, practically and in every day service. That means that we have practically one-third of the gas consumption of from 13 to 39 per cent for the same service. So that you would need less gas through your distributing system and even assuming that an increase of consumers creates a greater demand for your gas changes such as Mr. Cartwright has outlined could very readily be made to the distributing system or possibly changes in the low pressure regulator systems and increasing the number of them. I think that could be worked out very satisfactorily and without very great expense. (Applause.)

MR. J. H. MAXON: Mr. President, there are two points in this discussion that I think ought to be fully emphasized; one raised by Mr. McDonald that it is obvious that we cannot reduce the delivering capacity of our low pressure systems and maintain the delivery of the quantity of gas that is needed. No Company practically can stand the additional investment to attempt any such experiments.

The other point is that it may be entirely practical to standardize the pressure on the customer's premises which probably is desirable so that regardless of the pressure on the distributing mains there may be a continuous certain pressure on the piping of the particular building. That has been followed successfully in many instances. In some instances by appliances manufacturers installing on the equipment a regulator that was adjusted so that the boilers—I refer to heating boilers,—worked always on a low pressure. That has furnished very satisfactory results as to efficiency. It is practical to install a sensitive regulator on the service of customers and by the particular sized piping in the building utilize gas more advantageously at lower pressures than it is now utilized. The customer, however, should be the one who bears the burden of the investment in the regulator, the enlarged pipe and the necessary appliances to get the full advantage out of the gas rather than the Gas Company.

MR. JOHN A. MILLER: Mr. President, I think Mr. Cartwright and Mr. McDonald are both right. They appeared to differ with each other but I think they really agree on the main point. The main issue in this whole controversy I think can be

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settled by having uniform pressure whether it be one ounce, two ounces or one-half inch water, having uniform pressure at each house throughout the twenty-four hours and then have your appliance adjusted to that pressure. I think that will solve the difficulty. If the main system is not in such condition that the pressure can be maintained then you should install a regulator. I have always contended that natural gas ranges are very inefficient from the appliance standpoint and they certainly should be changed as rapidly as possible in order to make them efficient.

In regard to the question of pressure it does not matter what your pressure in different parts of the town is so long as it is maintained at the same point throughout the twenty-four hours in the various districts of the town. I think that would settle the whole controversy.

MR. CHARLES V. CRITCHFIELD: Just as a matter of information on the question of introducing individual regulators, we have in Ohio a Gas Company that is unique. It is an artificial gas company distributing gas under high pressure. As I recall it there are about ten towns furnished by this company three of which are county seats. They distribute artificial gas through their small mains,—2 and 3 inch mains under a pressure of 8 and 10 pounds and every single consumer is served through an individual regulator. This company has been in operation some three or four years and the distribution of their product has been entirely successful.

MR. J. C. MCDOWELL: I suppose there are 60,000 individual regulators in this city.

MR. DONALD MCDONALD: Mr. President, I don't want to be a brake on the wheels of progress but I am also dead set against house regulators and I will tell you why. First of all, we don't need them. In the second place the consumers' pipes are generally speaking not large enough to distribute through his own house at a low pressure. The place to regulate gas is at the key of the appliance in which you are burning it. Any burner will do proportionately better under one inch pressure. The stove in any City will work better under one inch pressure than under higher pressure up to that appliance. If the con-

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sumer gets better results at one inch pressure than he does at four inch—as most of them would—why can't he turn that little cock just a little bit and put the flame down to where he wants it? As a matter of fact that is what he does. We get no complaints from too much pressure. If we turn the pressure down in our mains and the consumers open their stop cocks wide then if the pressure goes up in the main, the blaze would whistle and there would be complaints all over town. But what actually happens is that each consumer turns down his heating stove, his cooking stove and his furnace to that point that satisfies his individual needs and to have automatic appliances on his house which will furnish uniform pressure in the cellar and probably give a fairly good result at the cooking stove but would give no gas at all in the third story will not satisfy the needs of the individual consumer. It imposes a large investment on our consumer, and I will tell you another thing; all of these automatic regulators are equipped with rubber diaphragms and in time they will get stiff and lose their elasticity and ultimately break and in due course of time you will get the complaint that somebody's house is about to be blown up.

As I said before I don't want to stand in the way of progress but it seems to me that if you want your customers to use your gas at low pressure then let the individual customer regulate it himself at the key of the appliance in which he is burning it. (Applause.)

MR. L. B. DENNING: Mr. President, I do not want to prolong this discussion any longer than is necessary but I am afraid that Mr. McDonald has not been up against the point which he suggests. I have. I want to say if the obligation is fastened on the Gas Company to furnish adaquate pressure at the consumer's burner it is going to bankrupt every Gas Company in the business. I had an illustration of that last winter, and I went through a series of litigation on it. I want to say to this Association that I do not believe any Gas Company has thrust upon it the obligation to furnish to the customer all of the gas necessary for the customer's wants at the tip of the burner. The minute you do that you put yourself absolutely under the control of the consumer and for your own self-preservation and to

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keep out of bankruptcy you will have to make your point of delivery the point where you deliver the gas to the premises of the customer. If you assume that your obligation is to supply the gas to the tip of the consumer's burner—and I will say I have been up against that proposition in a public way—then you have handed the control of your business directly over to the consumer. Otherwise you are turning over the control of your business to the consumer and you immediately become liable for something which you cannot possibly control and which in the end leads to bankruptcy. (Applause.)

PRESIDENT GUFFEY: Any further discussion? If not, we will proceed with the Reports of Committees.

The next Committee to report is the Committee on Time and Place of Next Meeting, of which Mr. Broder is Chairman.

Mr. William J. Broder then submitted the following:

REPORT OF COMMITTEE ON TIME AND PLACE OF NEXT MEETING.

Mr. President and Gentlemen: Your Committee on Time and Place of Next Meeting would recommend that the definite determination of the time and place of the next meeting be left to the Directors of the Association, with the further suggestion that in the event that a meeting is held, it be held either the second or third Tuesday of May, and that Columbus, Ohio, be favorably considered as the place.

Respectfully submitted,

W. J. BRODER,
L. ADAMS,
L. A. SEYFFERT.

PRESIDENT GUFFEY: Gentlemen, you have heard the report of this Committee. What is your pleasure?

MR. FRANK L. CHASE: Mr. President, I move that the report be adopted and filed as a part of the records of the Association, and that it be spread upon the minutes.

MR. J. C. MCDOWELL: I second the motion.

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And thereupon the above motion, having been duly seconded, the same was unanimously carried.

PRESIDENT GUFFEY: Is Mr. Brown, Editor of the Wrinkle Department, present? If so, we will now hear the report from his department.

MR. W. RE BROWN, New Business Manager, The Ohio Fuel Supply Company, Columbus, Ohio, then submitted the following:

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WRINKLE DEPARTMENT.

W. RE BROWN, Editor,
ALBERT J. DIESCHER, *Assistant Editor.*

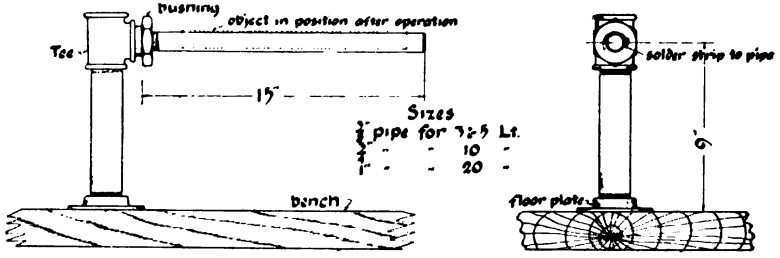
WRINKLE NO. 1

A PRACTICAL DEVICE FOR FORMING SIDE-PIPE METER REPAIRS

W. G. ALLEN, METER REPAIR DEPT. THE EAST OHIO GAS COMPANY, CLEVELAND, O.

The accompanying drawing shows a practical tool for use in forming side-pipes for meter repairs.

The shape of the pipe to be made makes it difficult to form with the facilities at hand in most meter repair departments.



Device for forming side pipes for meter-repairs

WRINKLE No. 1

Use ordinary gas pipe, cut in 15" length, with one end threaded; attach bushing, and screw into tee.

Fold a strip of tin, ½" wide, 15" long, allowing space to insert piece to be formed, solder to side of pipe.

Place piece in groove and bend toward you, with both hands turn it around and repeat operation.

Saves time and looks neat when finished.

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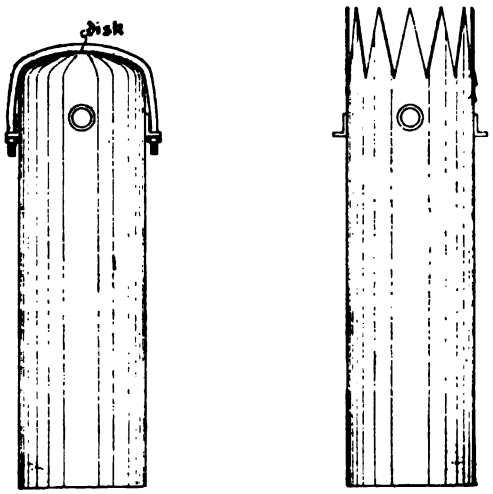
WRINKLE NO. 2

METHODS OF REINFORCING WELDED FITTINGS

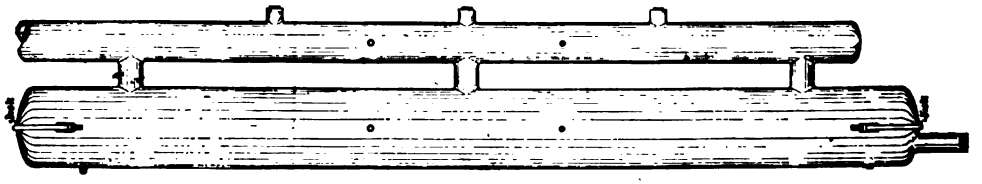
FRED DOOLING, THE EAST OHIO GAS COMPANY, CLEVELAND, O.

The accompanying drawings show a good method of welding shut the ends of pipe, so as to withstand high pressure. The



WRINKLE NO. 2

drawing of the welded header also illustrates how a strong header can be made up quickly and sufficiently strong to withstand high pressure.



WRINKLE NO. 2

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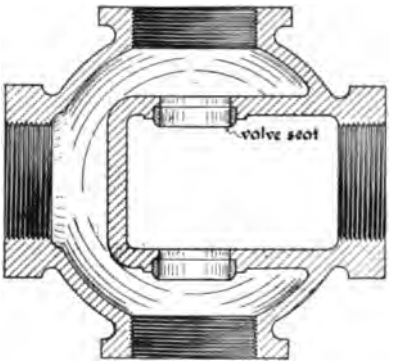
WRINKLE NO. 3

METHOD OF REPAIRING VALVE SEATS IN HIGH AND LOW PRESSURE REGULATORS

FRED DOOLING, THE EAST OHIO GAS COMPANY, CLEVELAND, O.

This drawing shows how the valve seat in regulators can be replaced. The old valve seat is cut away and a recess



WRINKLE No. 3.

machined in the body of the valve, so that a new valve seat can be driven in.

WRINKLE NO. 4

METHOD OF THAWING OUT FROZEN GAS LINES AND GAS SERVICES

J. P. LAUGHLIN, FOREMAN, THE EAST OHIO GAS COMPANY, AKRON, OHIO.

During the past winter we were obliged to thaw out a number of frozen services and frozen gas mains and found that it could be very easily done by the use of a small portable high pressure steam boiler and a ½" steam hose. After a portion of the gas pipe has been exposed and cut apart the ½" steam line is pushed through the gas line and it thaws its way through very easily.

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WRINKLE NO. 5

COMPARISON OF THE VOLUME OF GAS AT DIFFERENT PRESSURES

KARL EMMERLING, EAST OHIO GAS CO., CLEVELAND, O.

This photograph shows a convincing method of proving that a certain volume of gas at four ounces pressure increases only slightly in volume when reduced to one ounce pressure. Two

WRINKLE NO. 5

10-foot provers are connected together, and one of the provers weighted in order that the gas contained therein is at a pressure of four ounces. The gas is passed from this prover to the other prover which is weighted to give a one ounce pressure.

WRINKLE NO. 6

GAS AIR LIFT

G. E. HOWARD, MASTER MECHANIC, THE OHIO FUEL SUPPLY CO., 52 W. GAY STREET, COLUMBUS, OHIO

This is an apparatus for pumping water wells by means of the energy usually lost in passing fuel gas through a high pressure

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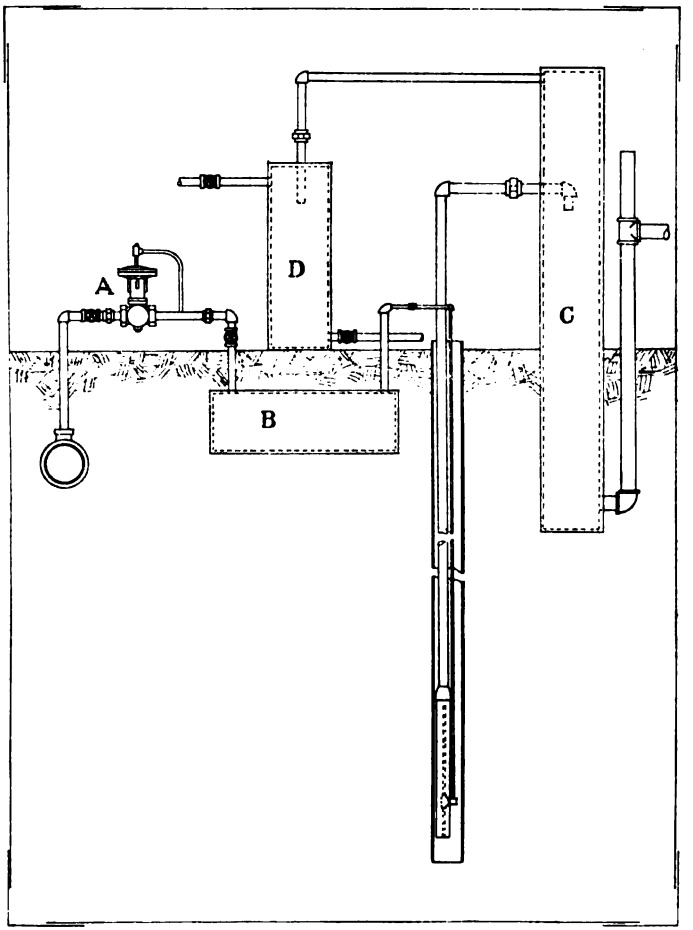
regulator. Gas from a high pressure line is passed through the small regulator "A" to reduce it to the pressure at which the wells will flow the greatest volume without blowing through.



WRINKLE No. 6 — (SEE PAGE 216)

From the regulator it goes into the surge tank "B" to neutralize pulsations. Passing out of this tank it flows the wells in the manner of an ordinary air lift.

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In order to recover the gas, the mixture of gas and water is discharged into the trap tank "C". From here the water flows out through the riser pipe opening out of the bottom of the tank. The tee in this pipe should be at sufficient height to prevent internal pressure from forcing the water level down to the outlet, and allowing the gas to escape. This vertical distance will be determined by the pressure to be carried in the fuel line. A vent should be left in the highest point of the riser to prevent siphoning.

From the trap tank, the gas passes out at the top and into the drip tank "D", from where it goes directly into the fuel line. Whatever amount of water is carried over from tank "C" will collect and can be blown off through the drip in the bottom of tank "D".

The tanks can be conveniently made by welding heads into pieces of 18″ pipe.

WRINKLE NO. 7

A FLEXIBLE AND HANDY METHOD OF USING TOPOGRAPHIC SURVEY MAPS

E. C. RAMSEY, ENGINEER, THE OHIO FUEL SUPPLY COMPANY, COLUMBUS, OHIO

(SEE DRAWING ON PAGE 219)

The use of topographic survey maps for field work led to the following wrinkle which has fulfilled all requirements so admirably that I am passing it along the line to assist others who use the topographic maps.

Several methods were tried out before this one was hit upon. The topographic sheets being of such an inflexible size, even after being trimmed, make an unwieldy map when a number of them are mounted together and this method limits the maps in their scope. Another method, from which the present method was an outgrowth, consisted in cutting the sheets into nine pieces and mounting them with enough space between each piece to allow for folding. This method has several faults, the greatest one being the added bulk and weight due to the cloth backing and that when only one corner of a quadrangle is required, it is necessary to carry the whole sheet.

The present method forestalls all the faults of the two above mentioned plans and is the most desirable yet hit upon.

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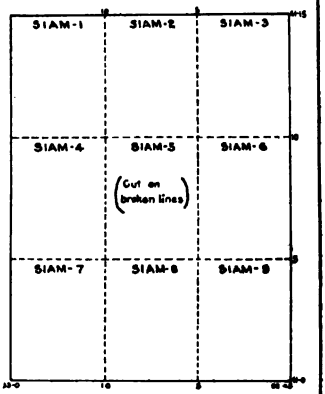
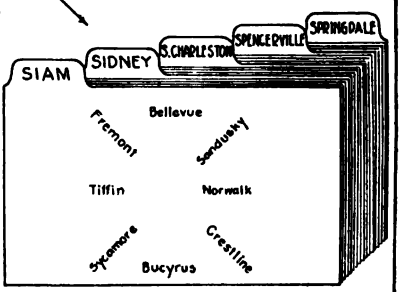
A FLEXIBLE AND HANDY METHOD OF USING TOPOGRAPHIC SURVEY MAPS

Trim all edges.
Letter name of Quadrangle in top center of each 5 minute latitude division, numbering each from 1 to 9.....thus →
Cut on 5 minute lines each direction making 9 pieces.
File in numerical order.
Make index guide card (5 cut) for each Quadrangle and file in alphabetical order.
On each guide card show names of all adjoining Quadrangles. (See sketch)
A leather carrying case ¼"×5"×6" inside will hold sufficient maps for quite an extensive trip and is pocket size.
A larger case made of metal and covered with imitation leather makes the whole file portable for automobile trips or for field scout work.





By means of this file it is possible to go anywhere covered by the file by starting with any one square and simply keeping in mind the numbers that bound each small section. Thus: Siam-1 would be bounded by N-Bellevue 7; E-Siam-2; S-Siam-4; W-Tiffin-3

WRINKLE NO. 7 — (SEE PAGE 218)

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WRINKLE NO. 8

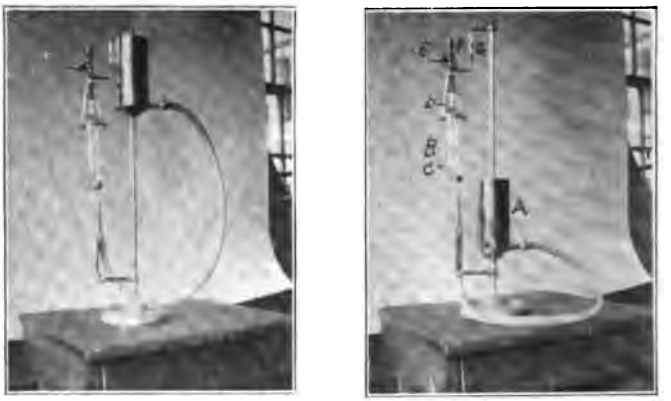
COMPACT INSTRUMENT FOR FINDING SPECIFIC GRAVITY

CHAS. E. PRATT, FOREMAN E. E. SHOP, EQUITABLE GAS CO., PITTSBURGH, PA.

This is an instrument for finding the specific gravity of gas.

It is very compact and can be carried in a small grip. All parts are detachable.

In using this instrument, there is no danger of mixing air with your gas when you are timing for gas.



WRINKLE No. 8

There is a movable water tank (a), this can be raised or lowered as desired, when up it is held by a spring stop.

The water bottle (b) is connected to the tank by rubber tubing, on the water bottle are two red lines, one on body at bottom (c) one on the neck at top (d).

These marks are used for timing the discharge of air or gas.

The hose cock (e) is used for filling the instrument with gas. By leaving the hose in place you are sure that no air can get in with the gas.

The orifice connection (f) where the gas or air is discharged

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from the bottle, there is a valve connected to this, which you operate each time you wish to time the gas or air.

The sleeve connection (g) is used to disconnect the two parts of the instrument for packing.

The instrument can be made with very little cost compared with other S-G instruments, and will save time in operation.

WRINKLE NO. 9

SHEET METAL PATTERNS FOR MAKING WELDED FITTINGS

ENGINEERING DEPARTMENT, THE EAST OHIO GAS COMPANY, CLEVELAND, OHIO.

The accompanying photograph shows some of our sheet metal patterns for making welded fittings. When making a "Y"

WRINKLE NO. 9

for instance, the proper pattern is placed over the pipe, so that the welder can mark off the hole which he is required to make in it. He uses another pattern to mark off the lateral on the proper bevel.

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WRINKLE NO. 10

METHODS OF DRAWING TOGETHER LONG SECTIONS OF WELDED STEEL PIPE

J. W. SULLIVAN, THE EAST OHIO GAS COMPANY, CLEVELAND, O.

The accompanying photograph shows an easy method of drawing two long sections of welded steel pipe together, so that the last weld can be made. A chain hoist of suitable capacity

WRINKLE NO. 10

is connected to one section of the pipe and the lifting chain is connected to the other section, so that the workmen can draw them closely together.

WRINKLE NO. 11

IMPROVED METHOD OF WEDGING OFF GAS LEAKS IN TRUNK PIPE LINES

H. J. TRUSCOTT, FOREMAN, EAST OHIO GAS CO., LOUDONVILLE, OHIO.

I have found that lead wedges such as are commonly used by builders of monuments, are more efficient than wooden wedges, for gas leaks in trunk pipe lines. These lead wedges come in strips and taper from zero to 3/8".

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WRINKLE NO. 12

METHOD OF TAPPING LARGE GAS MAINS

M. W. WALSH, SUPT. GAS DEPT. LOUISVILLE GAS AND ELECTRIC COMPANY, LOUISVILLE, KY.

The drawing on page 224 illustrates a method of tapping large cast iron mains, low pressure gas, without the use of expensive tapping machine, or the use of bags and running by-pass pipes around connection to be made, as is frequently done.

The object is to make connection without disturbing the flow of gas.

Size of cut required is marked off on main and diamond pointed cuts made as shown on drawing. Split tee is bolted around main in proper place and joints poured and calked; gate valve is placed, then flanged nipple with wood blind flange.

Tap and thread hole for ¾" pipe plug through tee and main as shown. Fasten wires to cap screws in the four parts of pipe to be broken out, extend these wires through valve and then bore holes in wood flange extending wires out far enough to be able to pull.

The pieces in cut are broken out by inserting a steel bar in hole and striking with sledge. The parts cut fall out with little hammering.

The ¾" hole is plugged up and gate valve closed after broken parts are pulled over into nipple.

WRINKLE NO. 13

DISAPPEARING WALL DESK

E. C. RAMSEY, ENGINEER, THE OHIO FUEL SUPPLY COMPANY, COLUMBUS, OHIO

(SEE DRAWING ON PAGE 225)

A device such as shown by the accompanying sketch has proven most satisfactory in providing a work table when incorporated as part of the equipment of a map case where maps of large dimensions mounted on rollers are used, on which much work has to be done.

The unwieldy nature of a large map makes it prohibitive to remove the map from its fastenings whenever any great

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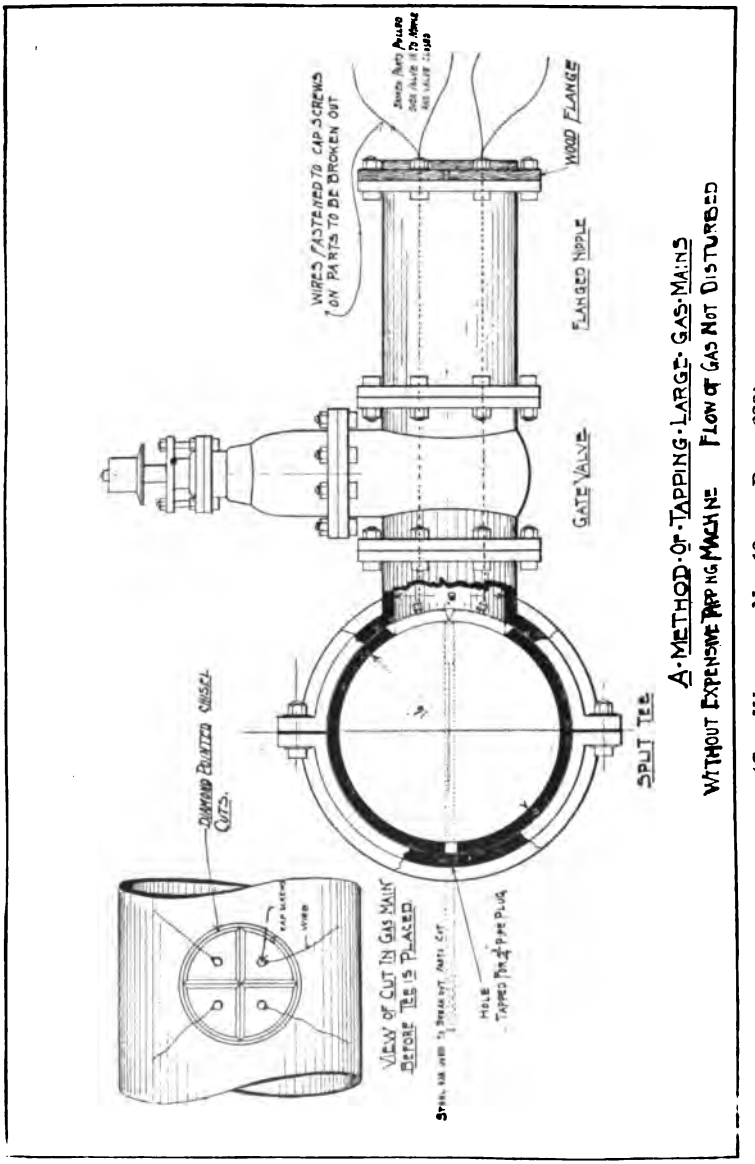
A METHOD OF TAPPING LARGE GAS MAINS
WITHOUT EXPENSIVE TAPPING MACHINE FLOW OF GAS NOT DISTURBED
WIRES FASTENED TO CAP SCREWS ON PARTS TO BE BROKEN OUT
WOOD FLANGE
FLANGED NIPPLE
GATE VALVE
SPLIT TEE
DIAMOND POINTED CHISEL CUTS
VIEW OF CUT IN GAS MAIN BEFORE TEE IS PLACED
HOLE TAPPED FOR ¼ PIPE PLUG

(See Wrinkle No. 12 on Page 223)

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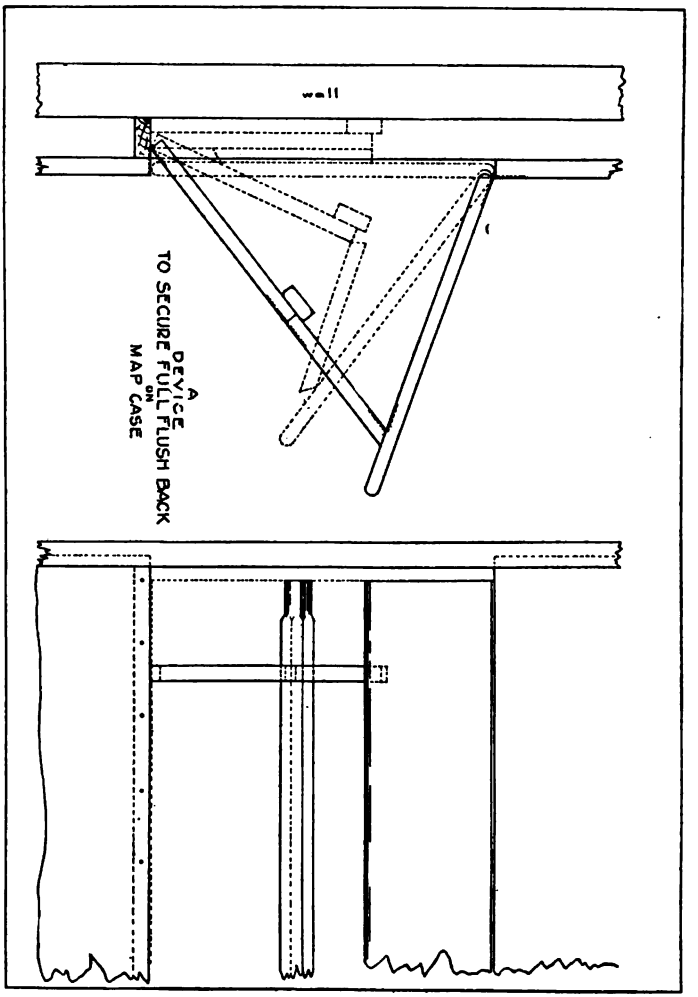
amount of revision is to be done and this is overcome by adapting the disappearing shelf as shown.

When required for use it is simply pulled up to position



(See Wrinkle No. 13 on Page 223)

when the knee joints drop automatically into place and form a rigid support sufficient to bear the weight of the person working on it. The number of supports is dependent, of course, on the

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length of the table. The height of the shelf is regulated to either a standing position or for use with a stool. The shelf is lowered by breaking the joint of the support when the shelf drops to vertical position of its own weight.

This same device is readily applicable for a standing desk or wall table where space is at a premium.

WRINKLE NO. 14

A SQUIRREL CAGE MAP ROLLER FOR LONG NARROW MAPS

E. C. RAMSEY, ENGINEER, THE OHIO FUEL SUPPLY COMPANY, COLUMBUS, OHIO

(SEE THE DRAWING ON PAGE 227)

A map five and one-half feet wide and seventeen feet long was found to be an unwieldy affair until the following squirrel cage roller was devised.

A light roller, pulleys on each end, was made by building up around a tin curtain roller a shell that would not be too heavy for the spring and one large enough in diameter to give a good map travel. The catches were removed from the end of the spring and strap iron brackets used for supports. A pulley on one end was used for pulling the map down and two other pulleys for pulling it up. The spring was wound tight enough to pull the map up when it was all unrolled.

The loose end of the map was taken care of by a roller of diameter about the size of the curtain roller fastened to the end of the map with spools attached to each end. Small ropes or cords were fastened to the ceiling and given several turns around the spools at each end and passed back up to the larger spools or pulleys on either ends of the upper roller.

Adjustments were made with the map just clearing the floor and when the map went up it reversed itself at the point of attachment on the smaller roller and the small roller raised with the end of the map.

When the map is pulled down the small roller drops until almost to the floor when it reverses and rolls the map up as it is unwound from the larger roller.

The maps are attached to the rollers with muslin at each end.

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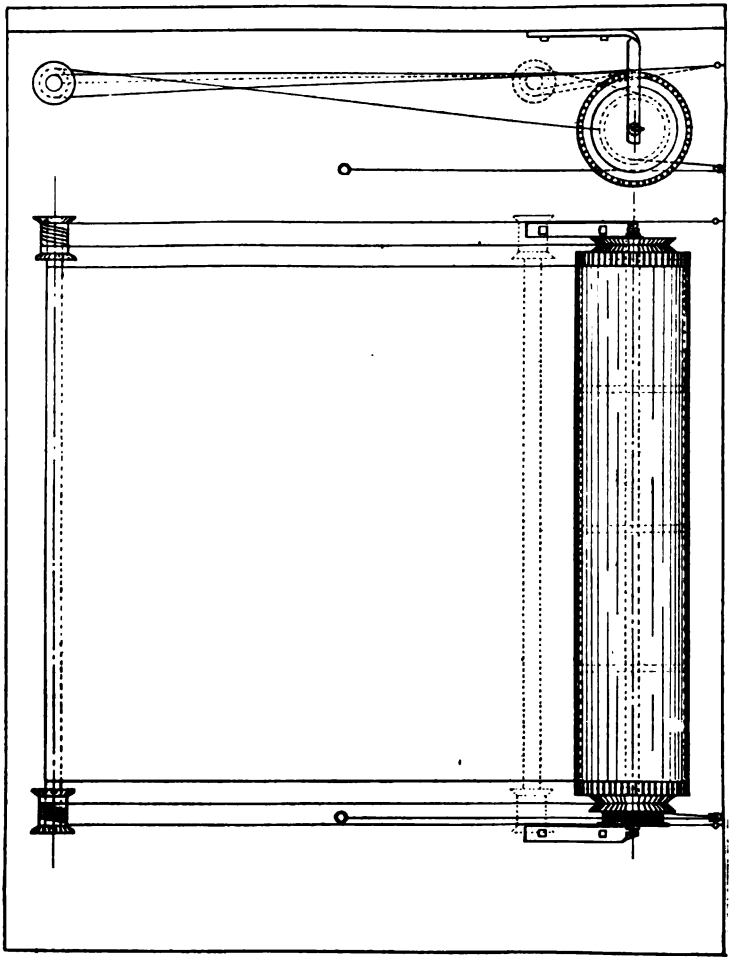

(See Wrinkle No. 14 on Page 226)

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WRINKLE NO. 15

PROTECTOR FOR HANDS WHEN WELDING

J. GRAHAM, WELDER, THE EAST OHIO GAS COMPANY,
WOOSTER, OHIO.

The picture shows a simple hand protector used by our welders when working in close places. It is made up of a

piece of asbestos board and placed around the welding torch between the workman's hands and the pipe that is being welded.

WRINKLE NO. 16

PIPE COUPLER SUPPORTS

M. P. CULLINS, BORDER GAS CO., LAREDO, TEXAS

(SEE PHOTOGRAPHS ON PAGE 229)

The photograph shows the pipe coupler support, which will give some idea as to how we prevent expansion and contraction by covering a joint occasionally with dirt, and again how we resist pressure from a stream where the line crosses a slight arroya.

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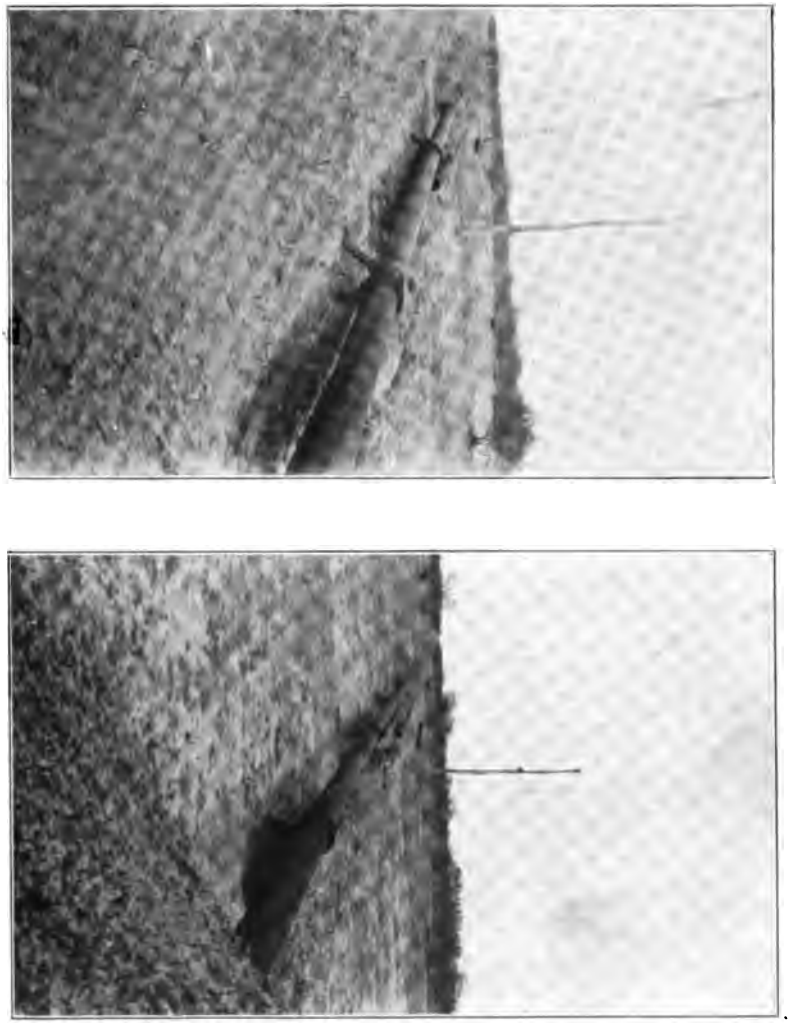

WRINKLE No. 16 — (SEE PAGE 228)

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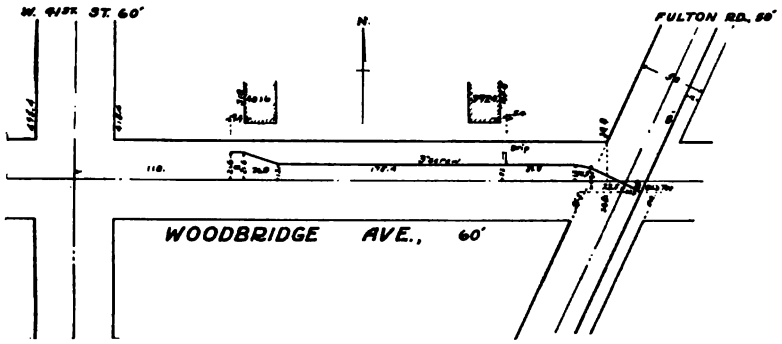
WRINKLE NO. 17

METHOD OF LOCATING GAS MAINS IN CLEVELAND

ENGINEERING DEPARTMENT, EAST OHIO GAS COMPANY, CLEVELAND, OHIO

The accompanying drawing shows the method of locating gas mains in the city of Cleveland.



WRINKLE NO. 17

Construction Order No. 9361.

Woodbridge Avenue—N. Side—Width of street 60 (1.0 fr walks)
3" Screw pipe

13.2	38.8	S of N P L 8 x 3 Tee open N & S	1 3" Screw Plug 2 1" Plugs
38.8		W P L Fulton rd R A	Drip: 5' 0" of 1" Screw Pipe
51.2	20.5	S of NPL Angle in pipe	2 1" Galv. Street Ells
55.5		W P L Fulton rd Pro	1 1 x ¾" Galv. Reducer
63.7	17.0	S of NPL Angle in pipe	1 ¾ x 4" Nipple
115.2	17.0	S of NPL low pnt 3.0 deep	1 ¾" Galv. Cap
115.2	8.0	S of NPL Drip riser	
120.6		E wall No 3924	By comparing the notes and map it will be seen that zero was established in the east property line of Fulton Road (prolonged) and that the base line was measured west and parallel.
290.6	17.0	S of NPL Angle in pipe	
317.4	8.4	S of NPL Angle in pipe	
318.0		W wall No 4016	
327.4	8.4	S of NPL End pipe plug	
415.4		EPL W 41st R A	
475.4		WPL W 41st R A	

Used: 316' 0" Screw Pipe Tarred and Wrapped.

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WRINKLE NO. 18

METHOD OF TESTING LONG SECTIONS OF WELDED STEEL LINE WITH HIGH PRESSURE AIR

FRED DOOLING, THE EAST OHIO GAS COMPANY, CLEVELAND, O.

The accompanying picture shows a stationary air compressor mounted on a wagon and driven from the rear wheel of a truck.

This method of testing the line with air was resorted to on account of a breakdown in our regular air testing equipment.

WRINKLE NO. 19

COMPLAINT AND METER READING BOOK IN ONE

W. M. KEENAN, THE EAST OHIO GAS COMPANY, YOUNGSTOWN, OHIO

By placing blank slips in the front of meter route books a handy record of complaints is made. It does away with reader carrying memorandum book. He can turn to blank slip and write his complaints.

When he reports in the office at quitting time, the complaint slips are torn from route book by clerk and orders issued to shop to have them repaired.

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WRINKLE NO. 20

WELDED STEEL OUTLET FOR CITY LOW PRESSURE REGULATOR

ENGINEERING DEPARTMENT, THE EAST OHIO GAS COMPANY, CLEVELAND, OHIO

This picture shows a welded cross and header wrapped with cloth and completely tarred, and is directly connected to the low pressure side of a regulator and serves as a very efficient outlet.

WRINKLE NO. 21

PIPE FITTERS' TOOL CABINET

C. M. ZARBOUGH, THE EAST OHIO GAS COMPANY, YOUNGSTOWN, OHIO.

A convenient individual tool cabinet for use of the pipe fitters working in the shop can be arranged by making a case and installing thirty-six drawers, each 16″ wide by 9″ high and 24″ deep. These drawers can be conveniently arranged four high and nine wide. Each drawer is equipped with a lock and two keys. One key is kept by the fitter and the other is left in care of the shop foreman, who can inspect conditions of the drawers at any time.

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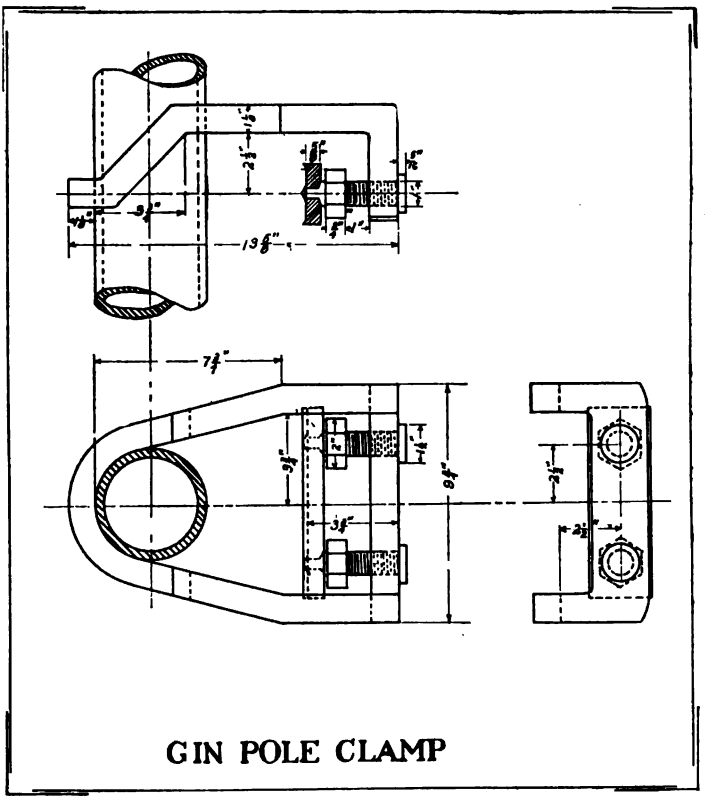
WRINKLE NO. 22

GIN POLE CLAMP FOR CARRYING PIPE

G. E. WAGNER, THE OHIO FUEL SUPPLY CO., COLUMBUS, O.

Much time is generally lost in loading or unloading large sized pipe from railroad cars, owing to the loosening of the



WRINKLE NO. 22

staple or clevice used to hold the gin pole to the car. The accompanying working drawing is for a clamp that will hold the pole firm and is more quickly adjusted than the staple and wedges commonly used.

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The clamp should be put around the pole before it is raised, after which it can be placed over the side of the car with the set bolts inside. A wrench of the proper size should be provided to turn the nuts which are welded to the bolts. If made to the dimensions shown there will be no danger of getting the clamp fast between the pipe and the side of the car as the standard used to hold the part of the load above the sides, will hold the pipe out enough to give plenty of clearance. The dimensions given provide for the use of a 4" ID pipe as a gin pole. If a larger pole is desired proper allowance can easily be made.

WRINKLE NO. 23

REMOVABLE DIRT SCREENS FOR INLETS OF REGULATORS

JOHN P. CURRY, AGENT, UNITED NATURAL GAS CO.,
SHARON, PA.

(SEE DRAWING ON PAGE 235)

The Regulator installation shown was devised for purpose of installing removable dirt screens in the inlets of each regulator, so that one regulator could be kept in operation while the other screen was removed to dump the dirt from screen. This obviates necessity of blowing back thru regulator to clear the old style permanent screens, usually installed in the regulator flange.

Where it would be thought expensive to use two regulators, gate could be used where one regulator is shown, and dispense with gate near 6 x 6 x 4 tee.

Installation can be supported by concrete support at point under "A" or by chains to roof of regulator building between regulators and inlet tees.

Installation shown can be installed in small building 6′ x 8′ and all points are easily accessible.

The regulator levers are not shown, but parallel the outlet, the governing pipe being tapped in side of outlet nipple, to not interfere with lever.

By removing the dirt screens, and using flashlight, the regulator valves and seats can be seen, and when desired, the valves

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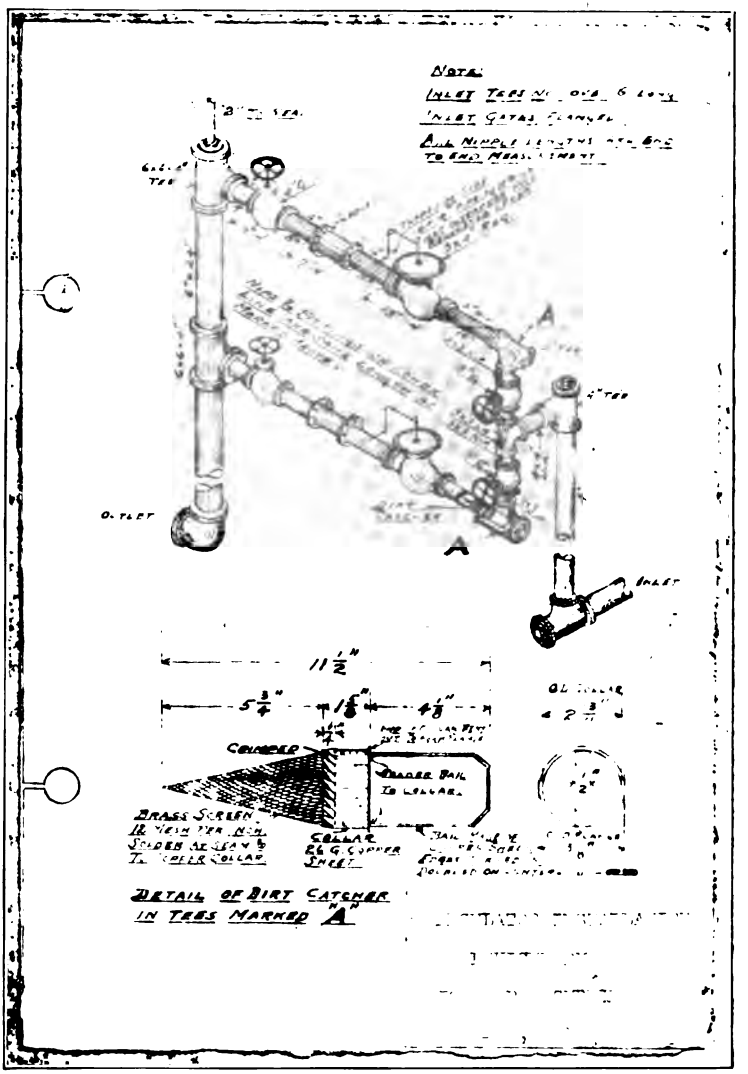

WRINKLE No. 23 — (SEE PAGE 234)

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can be removed thru the inlet tees, making it unnecessary to take down the regulators.

Plugs in inlet tees are recessed.

This wrinkle may be of value to some one who has dirt trouble.

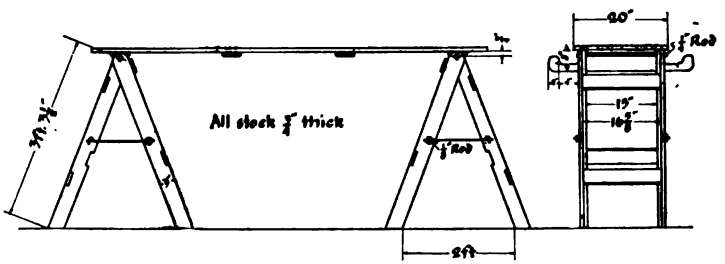
WRINKLE NO. 24

TRESTLES AND BOARD FOR WORKING ON LARGE WALL MAPS

HUGO J. EYERDAM, THE EAST OHIO GAS COMPANY, CLEVELAND, O.

It frequently becomes necessary to copy wall maps which have to be consulted by others while the work is going on.

This is usually done on a drafting table which is not built for that purpose, making it necessary to roll the upper and lower ends of the map. It also happens that some one is obliged to consult the map during copying and it never fails to be at



Trestles and board for working on large wall maps
by H.J. Eyerdam

WRINKLE NO. 24

a place other than where the draftsman is working, necessitating rolling and un-rolling of the map, making the new map which lays under it dirty.

This condition is overcome by allowing the map to hang on the wall and move the trestles and board close to it.

The board may be made from ¾" matched lumber planed and sand-papered with rounded edges and of a length to take

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the largest map and well cleated on the under side, the end cleats to be of such length that they will fit in between the legs of the trestles and rest upon the ¼" rod, allowing the board to project slightly beyond the legs of the trestles. The board may also be covered with beaver boarding in one piece.

The trestles are made collapsible and the legs fold into one another. They are made of ¾" stock 3" wide. The braces on the legs are mortised and a notch is cut in the leg which folds inside to receive the brace of the outer leg. The upper brace on the outside leg is not mortised and projects 6" beyond the leg and is hollowed out forming a socket to receive the slack ends of the map on each side of the board and is 3" below the bottom of the board. A ¾" rod acts as a hinge and is placed at a point so that the cleat resting upon it will just give clearance to the board or ¾" from top of legs. A ⅛" rod for hook and two eyelets keeps the legs from spreading greater than two feet. If the legs are made 39½" from floor to ¼" rod for hinge the proper height for working will be attained.

As the draftsman is working at the wall he will no doubt cast his own shadow upon his work, so it is essential to provide a movable light with shade.

WRINKLE NO. 25

PIPE BENDING DEVICE

WM. F. BLUM, SUPERINTENDENT, THE LOGAN NATURAL GAS & FUEL CO., LANCASTER, OHIO

We have used this device in bending our 18" and 10" pipe to great advantage. The drawing and directions for construction are intended for 18" pipe, however the size of the different pieces of wood being enlarged or diminished, accordingly, it may be used for any size of pipe, except that a very large sized pipe might require two jacks working side by side. We have used the device with one jack for bending two joints of 18" cold.

DIRECTIONS FOR CONSTRUCTION

"A" represents 2 wooden plugs, 10" long and 18" in diameter, to keep pipe from springing out of shape.

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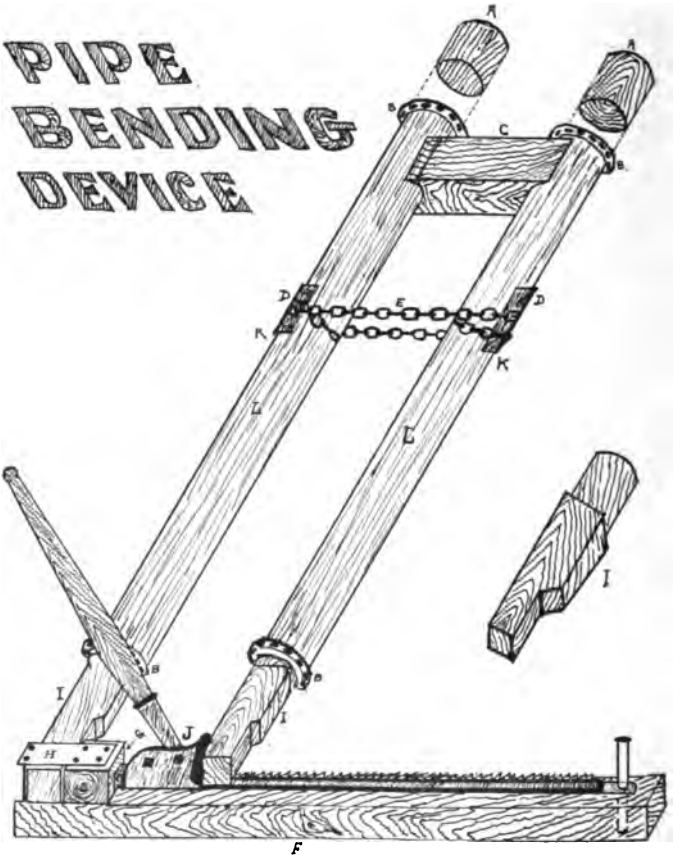
"B" represents 4 flanges, or followers, one at each end of the two joints of pipe, also to keep pipe from springing out of shape.

"C" represents a block of wood 14" x 14" x 16" long concaved to fit the pipe.



WRINKLE No. 25 — (SEE PAGE 237)

"D" represents 2 pieces of 18" pipe made by ripping a piece of pipe lengthwise into two parts. To keep chain from kinking the pipe.

"E" represents a chain 1" x 30" or more, with grab hook. (Wrap around pipes.)

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"F" represents 10″ x 8″ timber of sufficient length to take care of the straight track and the blocks of wood at the end.

"G" represents block of wood 10″ x 10″ x 12″ long, which is held in place by four of the bolts running through steel or iron plate (Fig. G) and through the 8″ x 10″ piece underneath.

"H" represents the plate of iron or steel which is held in place by six bolts, and takes care of holding the one piece Fig. I.

"I" represents 2 pieces of timber 18″ x 18″ x 12′ long, three feet at one end are rounded so as to be 18″ in diameter, in order to fit into the joint of pipe three feet. The remaining nine feet should be tapered down to 10″ x 10″ at the end.

"J" represents a straight track jack which is held in place, by the pin being inserted into a hole in the 8″ x 10″ timber at one end and the other end being against the block "G".

"K" represents the point at which the pipe will bend.

"L" represents the two joints of pipe, 18″ I. D.

By leaving both joints of pipe cold or heating both to the same heat they will in either case both bend alike, if only one joint is to be bent, heat the one, and leave the other cold. If both joints of pipe are to be bent the same, but one seems to be stiffer than the other, a little fire under this joint will cause it to yield more readily.

Good strong timbers should be used.

If the first bending is insufficient, release jack and either shorten the chain "E" or add blocking to "C", or both.

The chain "E" should be wrapped around both pipes to keep them from kinking.

WRINKLE NO. 26

HOW TO USE CARBON PAPER TO TRANSFER LEASE HOLDINGS TO LARGE WALL MAP

JOHN M. CRONIN, COLUMBIA GAS & ELEC. CO., CINCINNATI, OHIO

In the big gas companies where large wall maps are used considerable time is wasted in transferring to the wall map the

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outlines of leases secured, particularly when new surveys have been made of unplatted territory.

The following method has been used by our company for some time with a great deal of success:

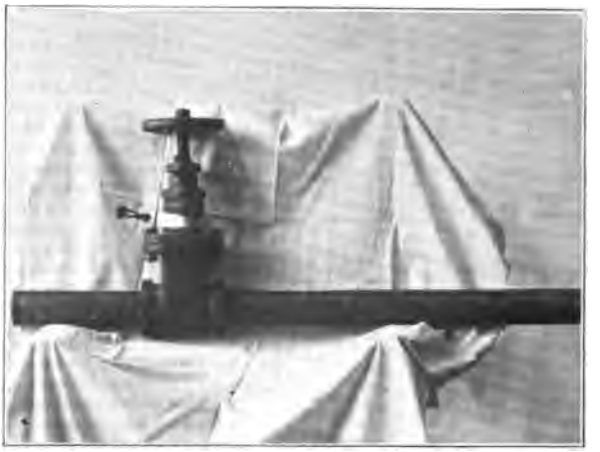
Tack the tracing on a piece of carbon with the business side of the carbon next to the tracing and go over the outline of the tracing with a stylus. This places the impression of the sketch, in carbon, on the under side of the paper. Tack the paper to the map and with a coin go over the outlines of the sketch and this will transfer the carbon impression to your map, which can be made more clear by either a pencil or a pen.

WRINKLE NO. 27

GATE SEAL FOR SMALL GATES

E. L. SAEGER, FOREMAN THE EAST OHIO GAS COMPANY, BARBERTON, O.

The attached photograph shows a simple inexpensive seal for sealing a small gate valve. It is made of two strips of sheet



WRINKLE NO. 27

iron with a hole punched in the four ends, so that a seal can be drawn through them.

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WRINKLE NO. 28

FOR STARTING A TAP IN DIRECTION DESIRED

MURRAY STRONG, FOREMAN ARKANSAS NATURAL GAS COMPANY, ARKADELPHIA, ARKANSAS

Attach a saddle of the right size firmly to the place where it is desired to make the tap. Screw the tap into the saddle, which acts as a guide for the tap.

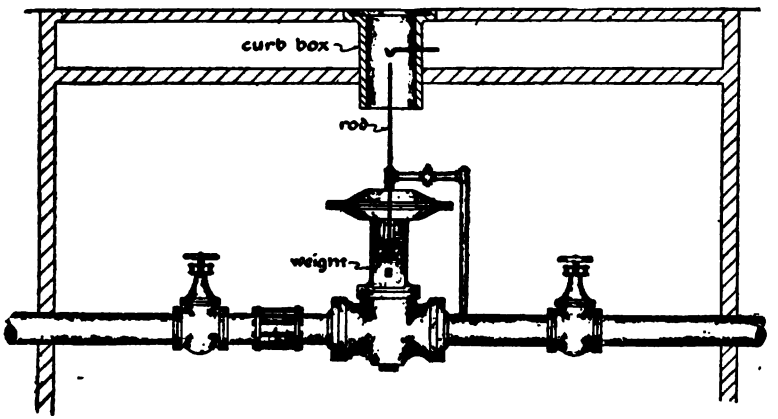
Using the saddle as outlined above overcomes all difficulty of starting the tap true.

WRINKLE NO. 29

REGULATIONS OF PRESSURE

M. MULLAY, THE EAST OHIO GAS COMPANY, YOUNGSTOWN, OHIO

The accompanying drawing shows a very convenient method of raising and lowering the pressure by means of a Chaplin-



Method for changing weights on regulators

WRINKLE NO. 29

Fulton regulator located in an under-ground vault. It is often necessary for the night man to decrease the pressure in the evening and to increase it again early in the morning. By plac-

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ing a gate box in the roof of a regulator vault directly over the weights on the regulator and tying the proper size weight to a chain, the weight can be removed at night and put back in place in the morning without the man entering the regulator vault.

WRINKLE NO. 30

PORT AND VALVE TEST GAUGE

JNO. H. SCHALEK, MANUFACTURERS LIGHT & HEAT CO., PITTSBURGH, PA.

(SEE DRAWING ON PAGE 243)

I have endeavored to make the drawing self-explanatory and if this instrument is constructed according to the specifications an excellent and dependable instrument for testing ports and diaphragms of meters of all kinds, will be the result. The gauge as shown is made for testing Keystone meter ports and diaphragms. In our shop (for the past three years) we have been using a gauge that did not contain an overflow chamber and the sight glass needed renewing too often to keep the workman's temper at an even keel. An hour's time in cleaning and replacing it was not exceptional.

A gauge constructed on the lines of the drawing has been in use now for over nine months and has not needed refilling or cleaning. To fill gauge with liquid open cock (B) and pour in enough liquid at the ⅜ inch plugged opening until the sight-glass shows about one inch of liquid. Replace the plug and close the cock (B). When testing ports and diaphragms screw meter inlet to the nipple (E). Place valve on seat so that the valve discharges directly and only into the diaphragm or port to be tested. If the diaphragm has been removed place a piece of putty in the diaphragm side of the port. Open cock (A) and by blowing slowly and steadily the liquid will rise in the sight-glass. When liquid has reached the desired height close cock (A). If the liquid level remains stationary the diaphragm and port may be considered gas-tight. If the liquid falls the leak may be anywhere between the meter inlet and the diaphragm. Causes of leakage are: uneven valve or seat; hole in valve; defective fastening of seat to meter casting; sandhole in

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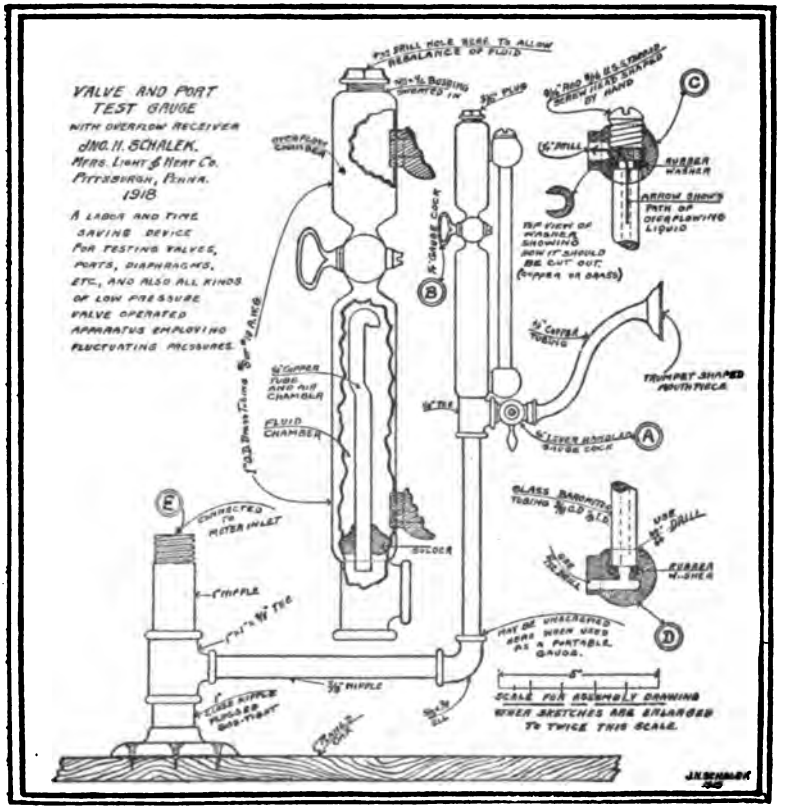
meter casting; hole in diaphragm; dry diaphragm; defective fastening of diaphragm to diaphragm-cover; sand hole in diaphragm cover. Other styles of ports may be tested with this gauge by unscrewing the gauge at the point shown in the drawing and fitting a sponge-rubber covered plate thereto. This ar-


VALVE AND PORT
TEST GAUGE
WITH OVERFLOW RECEIVER
JNO. H. SCHALEK.
MFRS. LIGHT & HEAT CO.
PITTSBURGH, PENNA.
1918
A LABOR AND TIME SAVING DEVICE FOR TESTING VALVES, PORTS, DIAPHRAGMS, ETC., AND ALSO ALL KINDS OF LOW PRESSURE VALVE OPERATED APPARATUS EMPLOYING FLUCTUATING PRESSURES.
RUBBER WASHER
TRUMPET SHAPED MOUTH PIECE
FLUID CHAMBER
SOLDER
SCALE FOR ASSEMBLY DRAWING
WHEN SKETCHES ARE ENLARGED TO TWICE THIS SCALE.

WRINKLE No. 30 — (SEE PAGE 242)

rangement will allow the testing of all slide valve meter ports and diaphragms and also the testing of Tobey meter ports and diaphragms. Drawing (C) shows clearly the top gauge-glass holder and (D) the bottom gauge- glass holder. All joints are sweated in and neatly finished with solder.

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The two most important features of this gauge are the overflow-chamber and the quick-renewable and leak-proof arrangement of fastening the sight-glasses. Oil, which does not discolor the sight-glass as water would may be used in the gauge. Waste of time and trouble in refilling gauge caused by an overflow of the liquid due to sudden and fluctuating pressures is also eliminated. Should the liquid overflow it is a very simple matter to open cock (B) and allow the liquid to return to its original chamber.

The gauge has been drawn at right angles to its normal position to show the construction more clearly. The gauge glass and mouth-piece should face the operator. No meter man will regret the making of this gauge.

WRINKLE NO. 31

LET FOLKS READ THEIR OWN METERS

L. G. TRELEAVEN, CONSUMERS LIGHT, HEAT AND POWER CO., TOPEKA, KANSAS

Allow me to present as my contribution to the "Wrinkle Department" the enclosed copy of our monthly bill, featuring the meter dial without hands.

The purpose of this dial is to do away with the great waste of time occasioned by verifying meter readings after bills have been delivered, and I also believe that it will do more to get consumers into the habit of reading their meters, something which all gas companies strive to accomplish, than anything which I have seen promoted.

This is not intended to interfere with the verifications sent for by the bookkeepers. We still continue to prevent, so far as possible, incorrect meter readings being billed. But we get hundreds of requests every month for verifications which seem like a positive waste of time. In these cases we ask the consumer to mark the position of the hands of the meter dial on the bill and, if his marking shows that an error was made, we will make whatever correction is necessary. The consumer is thus compelled to look at his meter and while marking the position of the hands does not teach him how to read it, it is a long step

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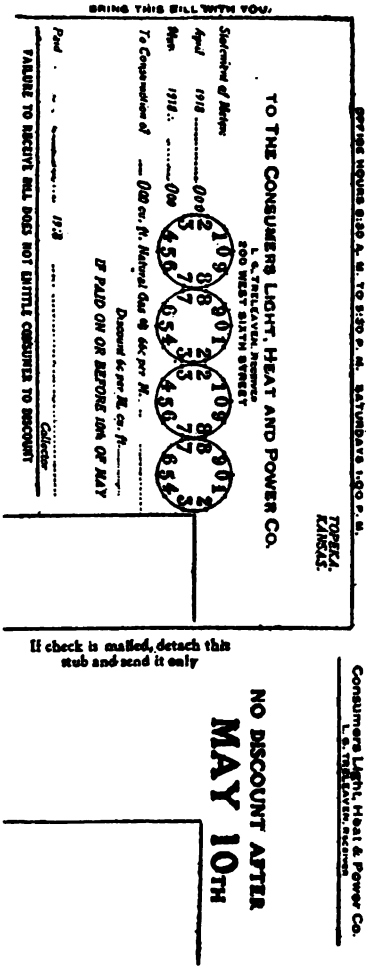
in that direction. It also pleases him to learn that we will accept the marking made by him as well as increasing his confidence in the integrity of the company.


BRING THIS BILL WITH YOU.
TO THE CONSUMERS LIGHT, HEAT AND POWER CO.
800 WEST SIXTH STREET
TOPEKA, KANSAS.
If check is mailed, detach this stub and send it only
NO DISCOUNT AFTER
MAY 10TH
IF PAID ON OR BEFORE 10th OF MAY
TAILURE TO RECEIVE BILL DOES NOT ENTITLE CONSUMER TO DISCOUNT

WRINKLE No 31 — (SEE PAGE 244)

It is needless to say that should a consumer mark a reading which looked suspicious we would hold up making the correction until we had a chance to get another reading ourselves, but we have had no such cases up to this time.

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We have had this plan in use for several months and it has proven to be very satisfactory, having done away with verifications on consumers complaints almost entirely. Occasionally a consumer will demur at being asked to mark the reading but when it is explained to him that it is right in line with the spirit of conservation, the elimination of unnecessary labor, he usually is won over.

We find the plan to be particularly effective in handling complaints made by telephone. It does away entirely with the necessity of looking up the consumer's account and then trying to convince him that the bill is probably correct. He is simply told that if there is any doubt in his mind of the correctness of the bill to mark the position of the hands on the dial printed on the bill and when he brings the bill in for payment we will correct it if wrong.

WRINKLE NO. 32

AUTOMATIC BOOSTER FOR LOW PRESSURE SYSTEM

F. J. MYERS, 1406 W. 14TH ST., OKLAHOMA CITY, OKLA.

Method for automatically boosting the pressure on the low pressure distributing system during times of large demand.

A cast flanged nipple of square cross-section is bolted to the outlet side of the regulator and the equalizer pipe extended into this nipple almost to the bottom. The lower end of the equalizer pipe is capped as shown in the sketch, the gas entering the equalizer pipe through a row of small holes "C" on the side facing the direction of gas flow.

As the velocity of the gas past the equalizer pipe increases it causes a suction at these holes thus producing a lower pressure in the equalizer pipe than then exists in the main, this is followed by an opening of the regulator valve and boost of pressure.

The reverse effect takes place with a decrease of gas velocity.

In order that the amount of boost may be regulated the nipple is made of square cross-section with hinged vanes on each side that are held apart by a spring but which can be closed to-

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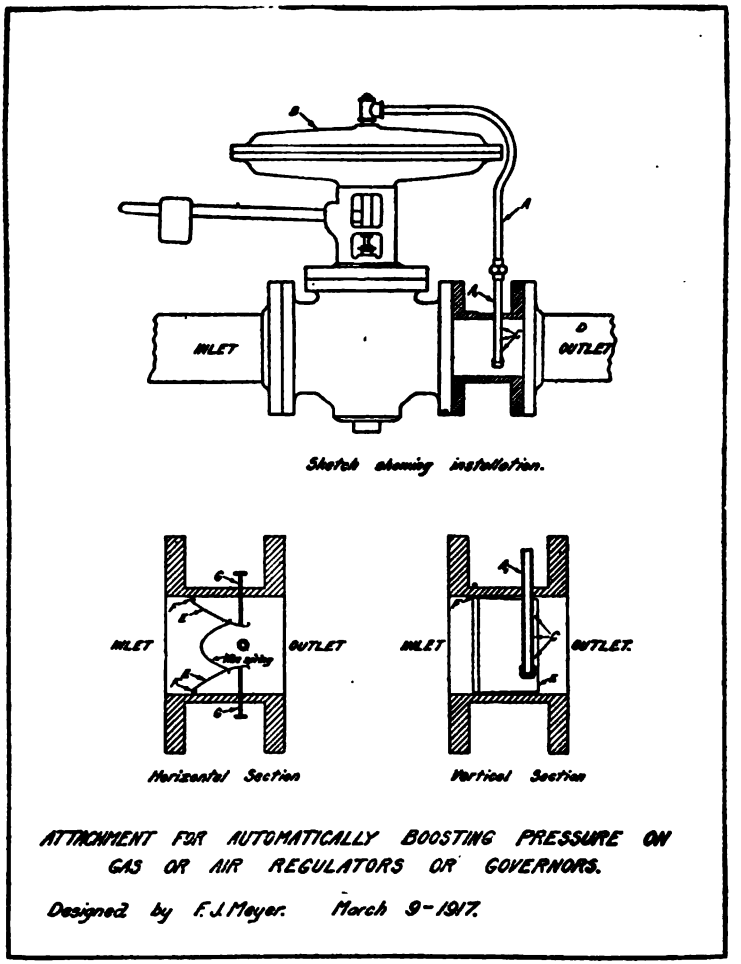
gether by two thumb screws thus increasing or decreasing the velocity of the gas with a given volume past the equalizer pipe.



WRINKLE No. 32 — (SEE PAGE 246)

With this wrinkle a constant pressure can be maintained at a distance from the regulator with a widely varying gas consumption.

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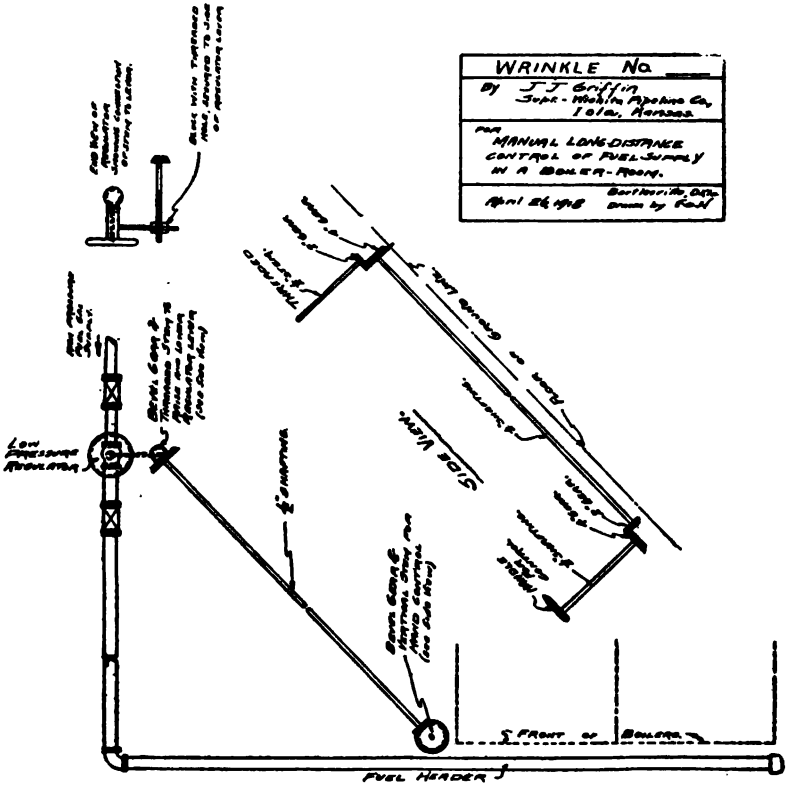
WRINKLE NO. 33

FOR MANUAL LONG-DISTANCE CONTROL OF GAS SUPPLY FOR A BOILER-ROOM

J. J. GRIFFIN, DISTRICT SUPERINTENDENT, WICHITA PIPELINE CO., IOLA, KANSAS

In the boiler house where this wrinkle was used, a regulator reduced the fuel gas from high pressure to a few ounces. Originally this regulator was connected on to the steam pressure,



WRINKLE No. 33

and the regulator would open further with a drop in the steam pressure, and vice versa.

When an orifice meter was subsequently installed to meas-

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ure the gas, the chart was so unsatisfactory, due to the fluctuating load, that it was decided to disconnect the steam pressure from the regulator. After this, the fireman had to regulate his gas at the regulator by hand. This meant a walk of some seventy-five feet each way a good many times a day. The double set of bevel gears and the shafting as shown made practically a distant-controlled throttling valve out of the regulator, and has given good satisfaction.

WRINKLE NO. 34

INSTALLATION FOR BURNING NATURAL GAS UNDER A BOILER, MADE OF PIPE AND ORDINARY FITTINGS

J. J. GRIFFIN, DISTRICT SUPERINTENDENT, WICHITA PIPELINE COMPANY, IOLA, KANSAS

The three drawings herewith illustrate a complete installation for burning natural gas under a boiler. With the exception of the mixers, it is all made of pipe, and can either be connected up by welding or by ordinary fittings.

The writer has installed a large number of these settings. The majority of his installations have been for low pressure heating boilers, and the drawings illustrate such type of setting. The design is applicable, however, to any boiler.

The gas burns in small flames, like a Bunsen-burner flame, slightly bluish with an inner green "leaf". This kind of installation has been able to compete against $2.00 coal in boilers where half a dozen burners of other types had failed. The combustion expert of the company with which the writer is connected, said it was "the most perfect combustion" he had ever seen under a boiler.

Figure 1 shows a plan of the supply header and of the distributing pipes which are put into the boiler thru the ash-pit doors and are therefore below the grate-level. The drawing shows the location of sixteen ¼" holes, drilled and tapped in the 2" pipes. Into these sixteen ¼" holes are screwed the mixer and burner proper. The number of burners will vary with each installation.

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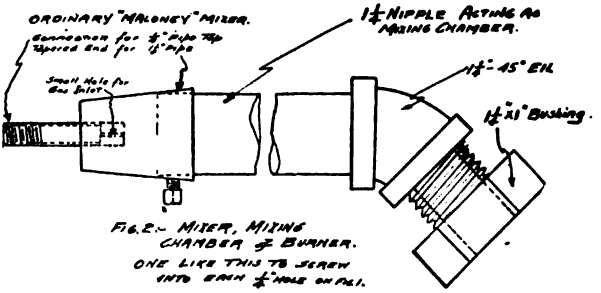

FIG. 2:- MIXER, MIXING CHAMBER & BURNER.
ONE LIKE THIS TO SCREW INTO BRICK ½" HOLE ON FIG. 1.

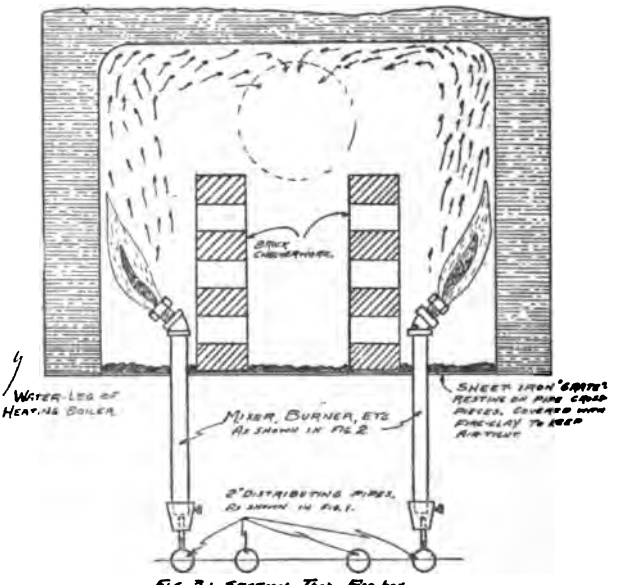
BRICK CHECKERWORK.
WATER-LEG OF HEATING BOILER.
MIXER, BURNER, ETC. AS SHOWN IN FIG. 2.
SHEET IRON "GATES" RESTING ON FIRE CLAY PIPES, COVERED WITH FIRE-CLAY TO KEEP AIR TIGHT.
2" DISTRIBUTING PIPES, AS SHOWN IN FIG. 1.

FIG. 3: SECTION THRU FIRE-BOX.
NOTE CHECKERWORK OR BRICK, ALSO DIRECTION OF 1½" 45° ELL. ARROWS SHOWN PATH OF HOT GASES.

WRINKLE No. 34 — (SEE PAGE 249)

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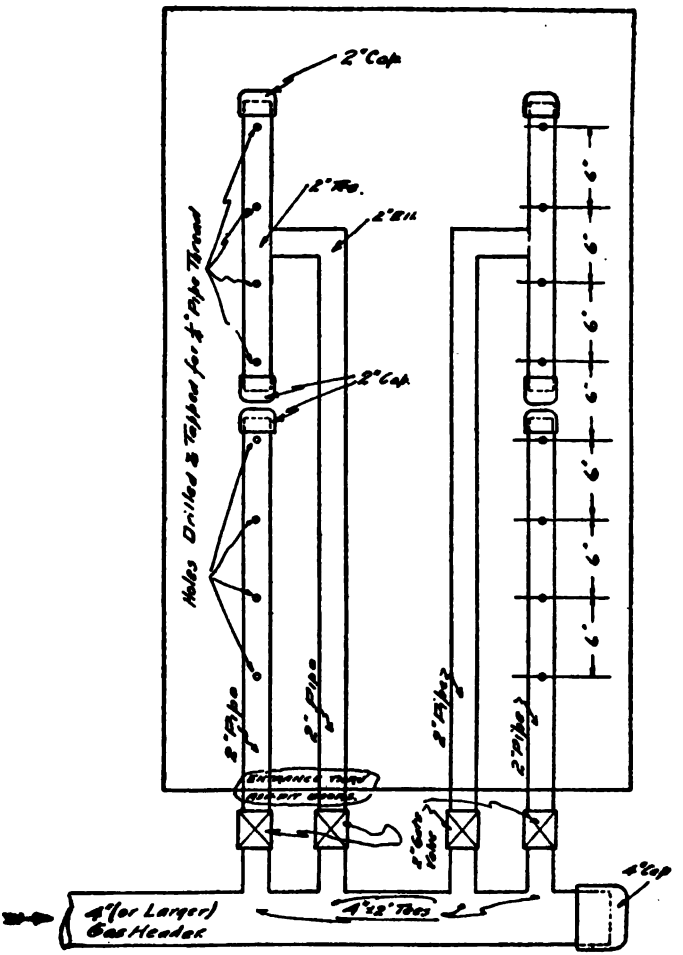

FIG. 1 - PLAN OF DISTRIBUTING PIPES, IN ASH-PIT.
CONNECTIONS CAN BE EITHER WELDED, OR SCREW FITTINGS.

WRINKLE NO. 34 — (SEE PAGE 249)

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Figure 2 shows the mixer, mixing chamber and "burner", as it is screwed into each ¼" hole. Besides the mixer, this consists of a 1¼" nipple, an 1⅜" 45-degree ell and a 1¼" x 1" bushing. The mixer used is the common Maloney mixer, known to every gas-man. It screws into a ¼" gas connection and has a tapered end for 1¼" pipe, the pipe being held in place by a set-screw. The best size hole for the gas opening for this arrangement is 4/32". The most satisfactory results have been obtained with the air shutter of the mixer removed. The length of the 1¼" mixing chamber will vary — 16" is an average length. The 45-degree ell is so turned that the flame burns away from the center of the fire-box, and directly towards the water-leg.

Figure 3 is a vertical section thru the boiler. It shows a fire-brick checkerwork which the writer has found to increase the efficiency. It also shows the "grate" of sheet iron covered with fire-clay to keep out excess air. There are holes in the iron for the 1¼" mixing chambers to pass up thru.

The arrows in the drawing show the path of the burnt gases — always in direct contact with the water surfaces. Therein lies the reason for the high efficiency of this setting.

If the boiler is running under capacity, it is possible to shut off one, two or three of the four sets of burners. The writer usually shuts the rear sets off first, on account of the longer travel of the hot gases from the front burners.

WRINKLE NO. 35

WHY NOT TRY USING SHINY SIDE OF TRACING CLOTH?

E. O. HICKSTEIN, EMPIRE GAS & FUEL CO., BARTLESVILLE, OKLA.

In drawing with ink on tracing cloth, the writer always uses the shiny side of the cloth. This is principally because it can be kept cleaner, and it erases a good deal easier.

He does not use pounce nor powdered chalk. All that he finds necessary is to rub the shiny side of the cloth briskly with a handkerchief or any sort of material for a half-minute or so. The ink will "take" very readily after this treatment.

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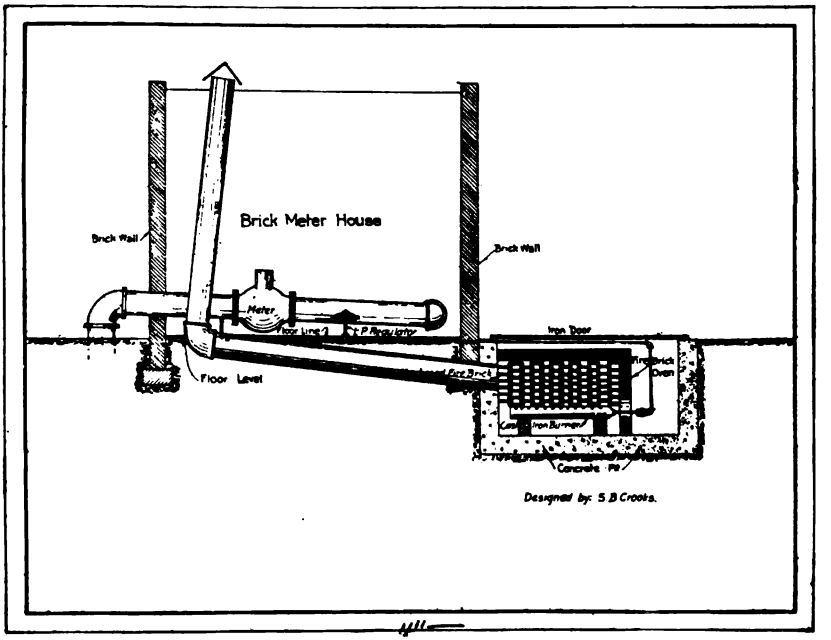
WRINKLE NO. 36

HEATER FOR TOWN BORDER METERS

DESIGNED BY S. B. CROOKS, ASST. GAS PIPE LINE DEPT., WICHITA NATURAL GAS COMPANY, BARTLESVILLE, OKLA.

A simple, but absolutely safe heater capable of close regulation:

In building this particular heater the 6¼" junk casing running from the furnace to the roof was first put in place. The



WRINKLE NO. 36

concrete was poured around it for the furnace pit. The meter house had a dirt floor and the heater pipe was left uncovered along the horizontal run. This trench can be covered, if desired, with a grating.

The regulator in the fuel line holds a constant pressure at the throttle valve which prevents variation in heat due to pres-

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sure changes at the meter. The iron door being locked down prevents tampering with burner.

The rest of this sketch is self-explanatory.

In later installations the furnace will be built on the ground instead of in a pit as in this case, this will permit of the heater pipe being installed level and above the floor of the meter house.

WRINKLE NO. 37

USE PIPE COUPLING RINGS BETWEEN SADDLE AND PIPE

J. J. GRIFFIN, DISTRICT SUPT., WICHITA PIPELINE C., IOLA, KANSAS

Pipe saddles are used everywhere for repairing leaky lines, tapping high pressure lines and for many other purposes. Most gas-men use either a rubber gasket or sheet lead between the saddle and the outside of the pipe and they will admit that neither exactly answers the purpose. The writer has found that the rubber rings from pipe couplings are just the thing. They are good and heavy, made of an excellent grade of rubber and the bevel of the rubber makes it fit very nicely.

WRINKLE NO. 38

SLIDE RULE FOR CALCULATING PROPORTIONAL METER DELIVERIES AT REDUCED PRESSURE

DESIGNED BY C. E. BROCK, ASST. SUPT. GAS LINES, WICHITA NATURAL GAS COMPANY, BARTLESVILLE, OKLAHOMA

(SEE DRAWING ON PAGE 255)

The outer scale of this rule consists of two complete logarithmic scales and the inside scale is made from one logarithmic scale and the inside scale is made from one logarithmic scale. The base constant is shown in absolute pressure and when reading pressure on the pressure scale it is necessary to add 14.4 pounds to the gauge pressure before finding the pressure on the scale. This rule will be found practical on all meter deliveries which do not read above 3 figures, and can be read approximately on the fourth figure.

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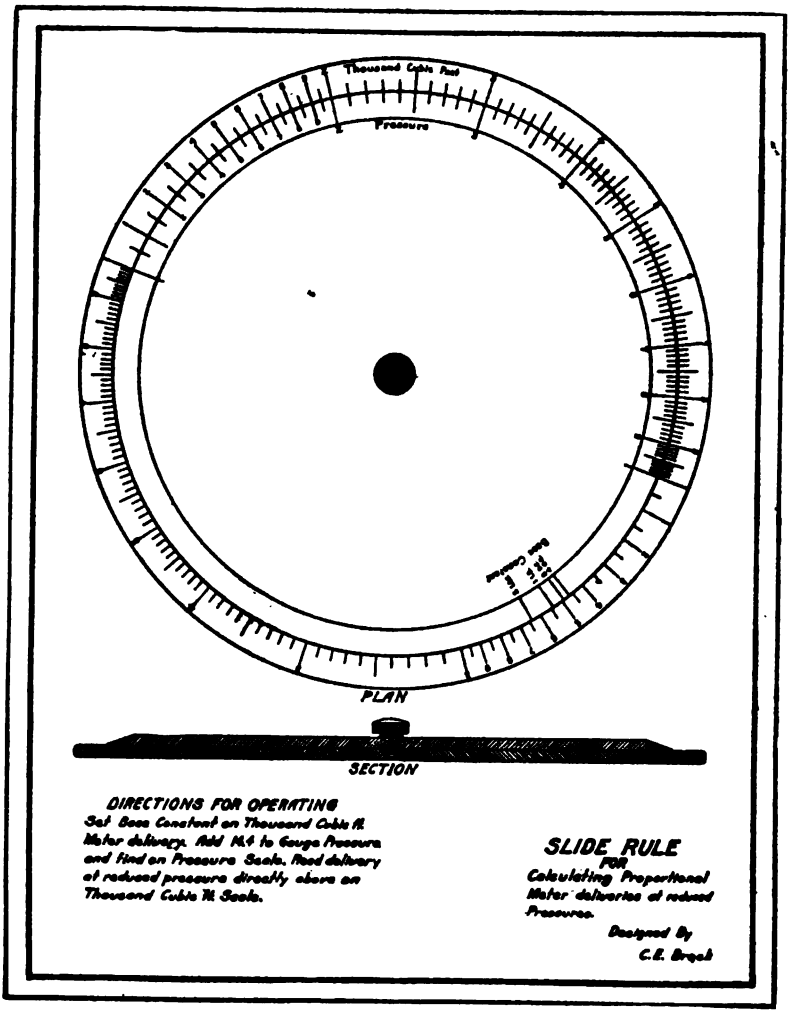
Thousand Cubic Feet
Pressure
PLAN
SECTION
DIRECTIONS FOR OPERATING
Set Base Constant on Thousand Cubic Ft. Meter delivery. Add 14.4 to Gauge Pressure and find on Pressure Scale. Read delivery at reduced pressure directly above on Thousand Cubic Ft. Scale.
SLIDE RULE
FOR
Calculating Proportional Meter deliveries at reduced Pressures.
Designed By
C.E. Brook

WRINKLE No 38 — (SEE PAGE 254)

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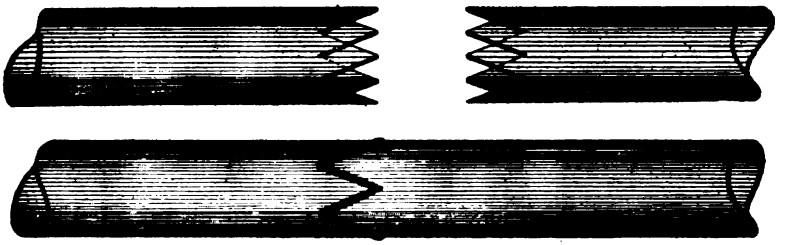
WRINKLE NO. 39

METHOD OF CUTTING JOINT BEFORE WELDING TO GIVE ADDITIONAL STRENGTH TO WELD

DESIGNED BY E. H. CYPHERT, CONSTRUCTION SUPERINTENDENT EMPIRE GAS & PIPE LINE COMPANY



METHOD OF CUTTING JOINT BEFORE WELDING TO GIVE ADDITIONAL STRENGTH TO WELD

We find in making welds through creeks or in sharp bends that we will have a much stronger job if the pipe is cut and welded as shown in the diagram.

WRINKLE NO. 40.

BALLARD PIPE LIFTING MACHINE

(SEE DRAWING ON PAGE 257)

This machine was constructed and designed by the Gas Pipe Line Department, Wichita Natural Gas Co.

The horse was made of 4" and 6" pipe. After pipe is uncovered 7 men and one team to draw the wagon can lift one mile of 18" pipe a day. In lifting 8", 10" and 12" pipe one can skip every other coupling and lift with good results. We used a winch with clutch on drum, also a brake so as to hold load at any given place. This was pulled by a 6 h. p. Novo Engine. We have lifted 9,000-pound gates out of ditch with this machine with ease, using a double and triple block.

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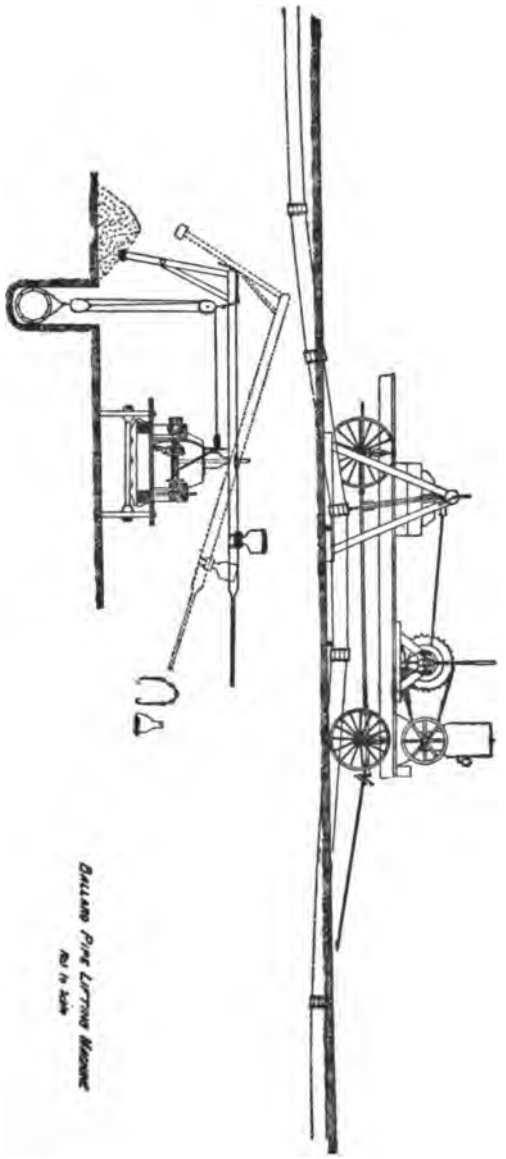

WRINKLE NO 40—(SEE PAGE 256)

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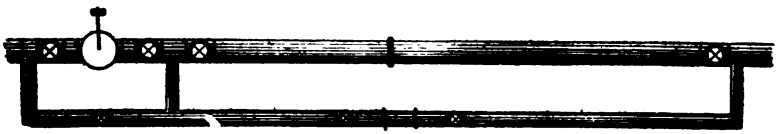
WRINKLE NO. 41

ORIFICE AND REGULATOR SETTING

DESIGNED BY S. B. CROOKS, WICHITA NATURAL GAS COMPANY, BARTLESVILLE, OKLA.

This setting was designed to meet with the approval of the government inspectors in the Osage County, Oklahoma District, and has been found to be very practical, as either the meter



WRINKLE NO. 41

or the regulator can be by-passed without shutting the other part of the setting. The sleeve shown in the diagram should be left out when the by-pass is not in use, thus making it impossible for any gas to pass through the by-pass line.

WRINKLE NO. 42

DRIP FOR HANDLING VERY WET WELLS OR LARGE AMOUNT OF GASOLINE

DESIGNED BY ROSS M. STUNTZ, SUPERINTENDENT GAS LINES, WICHITA NATURAL GAS COMPANY, BARTLESVILLE, OKLA.

Where a well makes a large amount of gasoline, we have found that this is the most practical drip for this purpose. The 16″ pipe giving plenty of room for expansion and under the ordinary conditions sufficient reservoir space for any well. The blow-off can be attached to the gasoline tank and the drip can be blown as often as necessary and all the gasoline saved.

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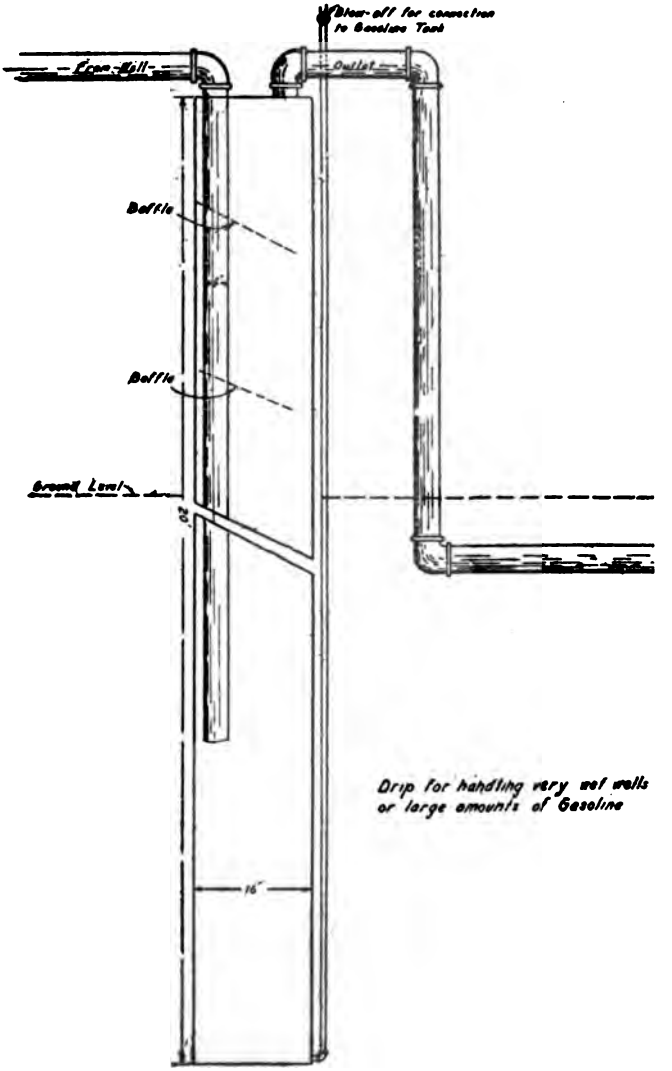

WRINKLE No. 42 — (SEE PAGE 258)

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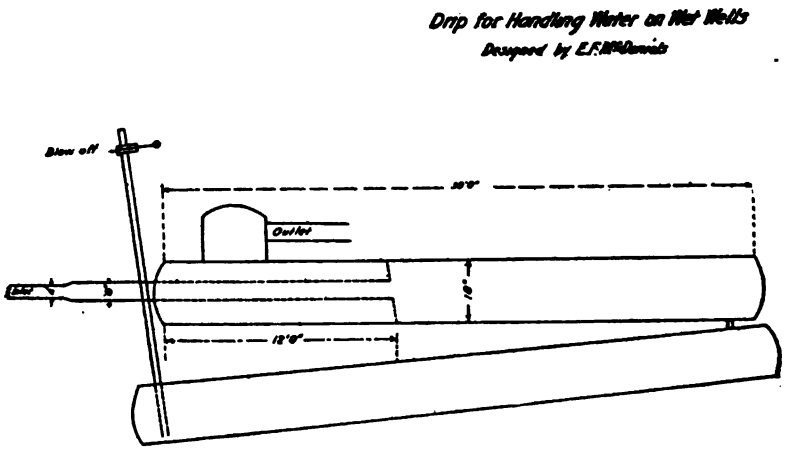
WRINKLE NO. 43

DRIP FOR HANDLING WATER ON WET WELLS

DESIGNED BY E. F. MCDANIELS, DISTRICT SUPERINTENDENT, WICHITA NATURAL GAS COMPANY

This drip has been found to be very practical for wells which are making a large amount of water. The drip is made



entirely by the weld process, which enables us to use pipe which would otherwise be worthless.

WRINKLE NO. 44

COMBINATION LEASE RENTAL CHECK AND RECEIPT

S. B. KELLY, ARKANSAS NATURAL GAS COMPANY, LITTLE ROCK, ARKANSAS

This form of check and receipt combined was devised and adopted to do away with the expense incurred in the old method of hand payment of rentals.

Note that it is intended to be mailed either direct to lessee or to named depository. The reverse side has the caption "Endorsement Below Is Receipt in Full Payment Of Rentals Due", consequently have a perfect receipt.

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Form L-D 1

ARKANSAS NATURAL GAS COMPANY

Lease No..... No. 29

Voucher No.....

Check No..... Little Rock, Ark.....191.....

Pay to the order of.....

For credit to the account of..... $.....

.....

in full payment of rental from.....191..... to.....191.....

on.....acres of land leased for oil and gas purposes by.....

to .....dated.....191..... and

situate in..... County, State of..... Parish,

To Commercial National Bank, Shreveport, La.

ARKANSAS NATURAL GAS COMPANY

.....

Auditor.

Wrinkle No. 44 — (See Page 260)

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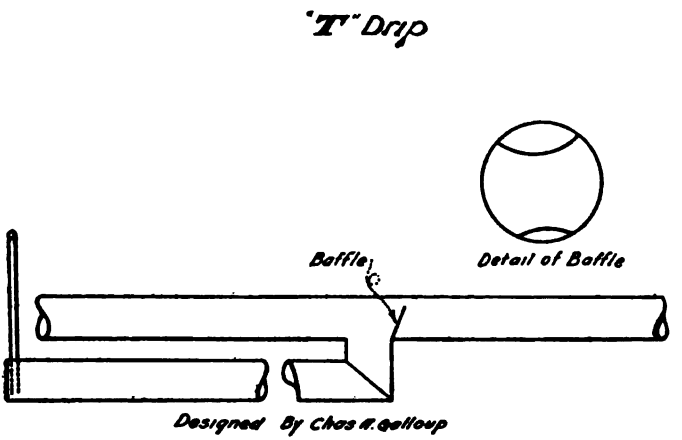
WRINKLE NO. 45

T-DRIP, WITH BAFFLE

DESIGNED BY CHAS. A. GALLOUP, CONNECTION SUPERINTENDENT, EMPIRE GAS & PIPE LINE COMPANY



This drip is made entirely by the welding process and has been found to be very practical in handling water or gasoline.

WRINKLE NO. 46

SWAGE NIPPLE HOLDER

DESIGNED BY JOHN FINK, GAS LINE DEPT., WICHITA NATURAL GAS COMPANY

(SEE DRAWING ON PAGE 263)

This simple machine is found to be very convenient around our pipe machine and welding shop in making swage nipples. The plates are faced and turned to receive 3″ to 18″ and 2″ to 12″ pipe, about 3 threads is all that is necessary to have turned in the plates, just enough to hold your nipples steady. The upper plate is fastened on a shaft, which works up and down, and held in place by dropping a dog down against bar. In this way we get a welded swage that is true.

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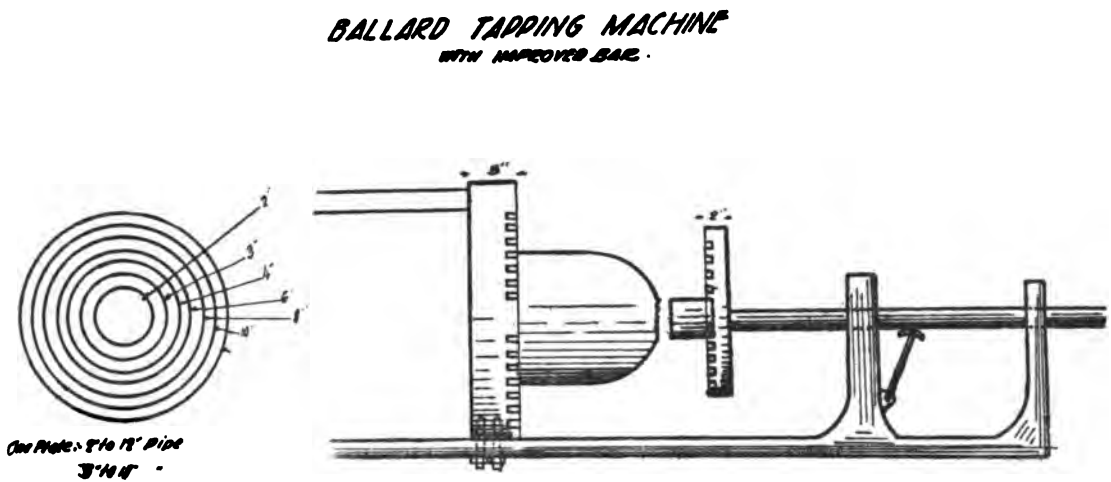

WRINKLE No 46 — (SEE PAGE 262)

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WRINKLE NO. 47

BALLARD IMPROVED BAR

JOHN FINK, GAS LINE DEPT., WICHITA NATURAL GAS CO., BARTLESVILLE, OKLA.

(SEE DRAWING ON PAGE 265)

This we find to be much quicker cutting bar, which we now use on making all of our taps on high pressure lines. We very seldom lose the piece of pipe which is milled out of the line.

WRINKLE NO. 48

TEMPORARY REPAIR OF LEAKY LOW PRESSURE PIPE

MURRAY STRONG, FOREMAN ARKANSAS NATURAL GAS COMPANY, ARKADELPHIA, ARKANSAS

Clean the rust and dirt from the pipe around the leak and paint with white lead. Place a rubber patch over the leak and wrap tightly with a fine nickel or copper wire, just as a broken base ball bat would be repaired.

This method is a quick way of making temporary repairs of leaks in low pressure lines.

WRINKLE NO. 49

WELDED LINE DRIP

D. E. SHADER, FIELD SUPERINTENDENT, EMPIRE GAS & FUEL COMPANY, CHAUTAUQUA, KANSAS

(SEE DRAWINGS AND INSERT)

This drip is especially recommended for very wet field lines. The sketch shows a 6″ separator used for 2″ and 3″ field lines but for larger field lines an increase in the size of separator, according to these proportions, is recommended. The more space in the separator the better results obtained.

The blow off for this drip is of the syphon type or a 1″ pipe inserted through the top of the reservoir to within 1″ of the bottom of the reservoir pipe.

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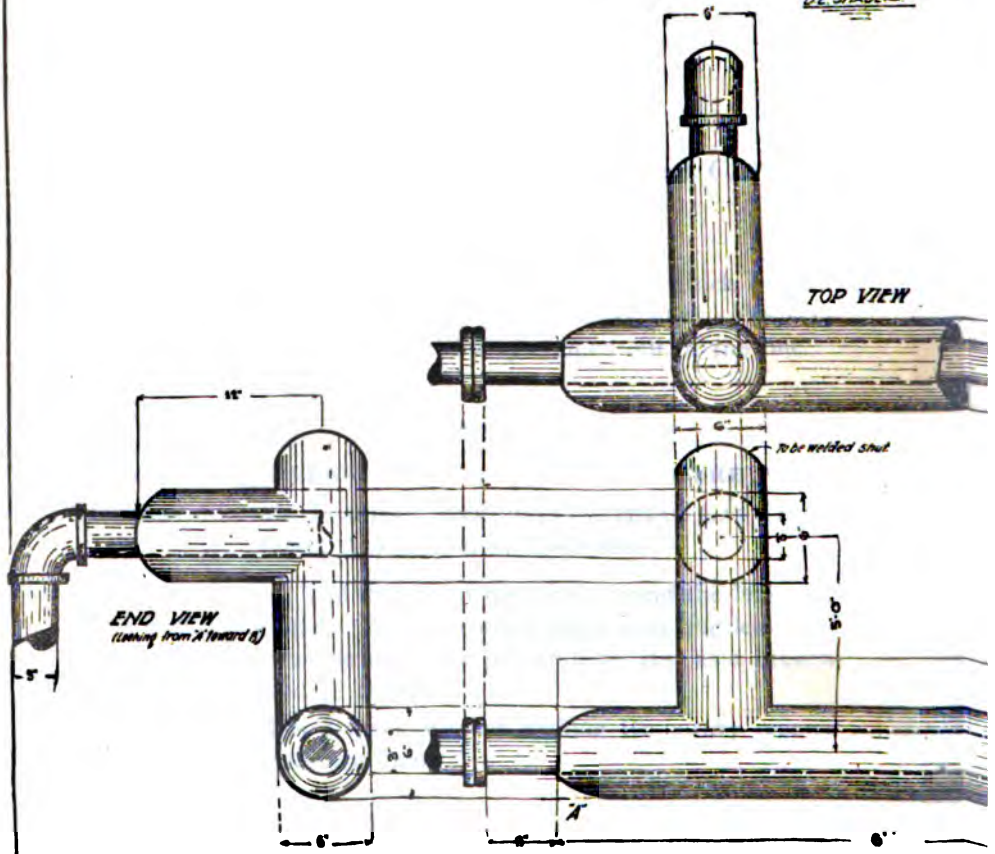
SKETCH OF DR

DESIGN OF —
D.C. SNADER



GENERAL VIEW

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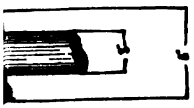
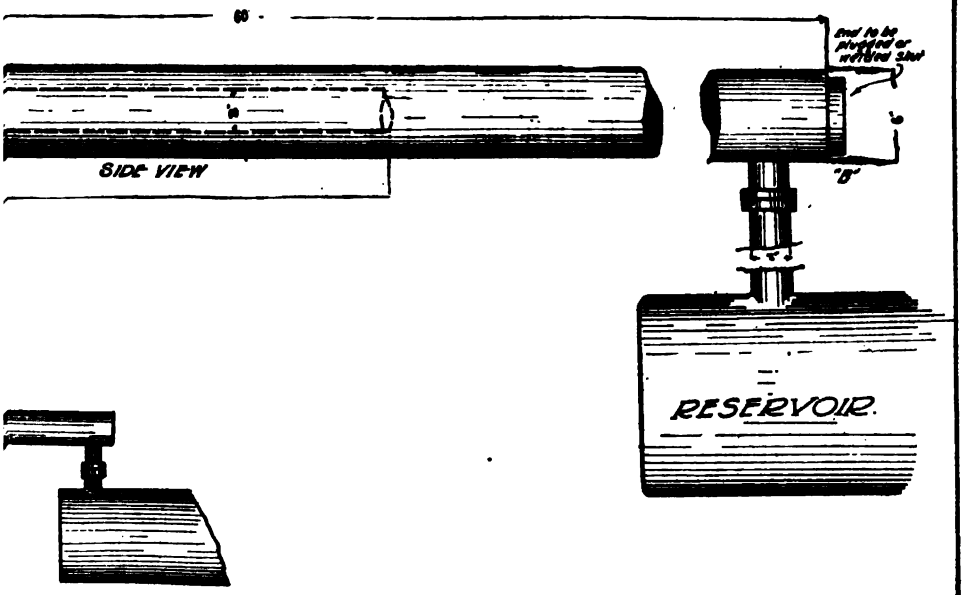
DRIP





(See Page 264)

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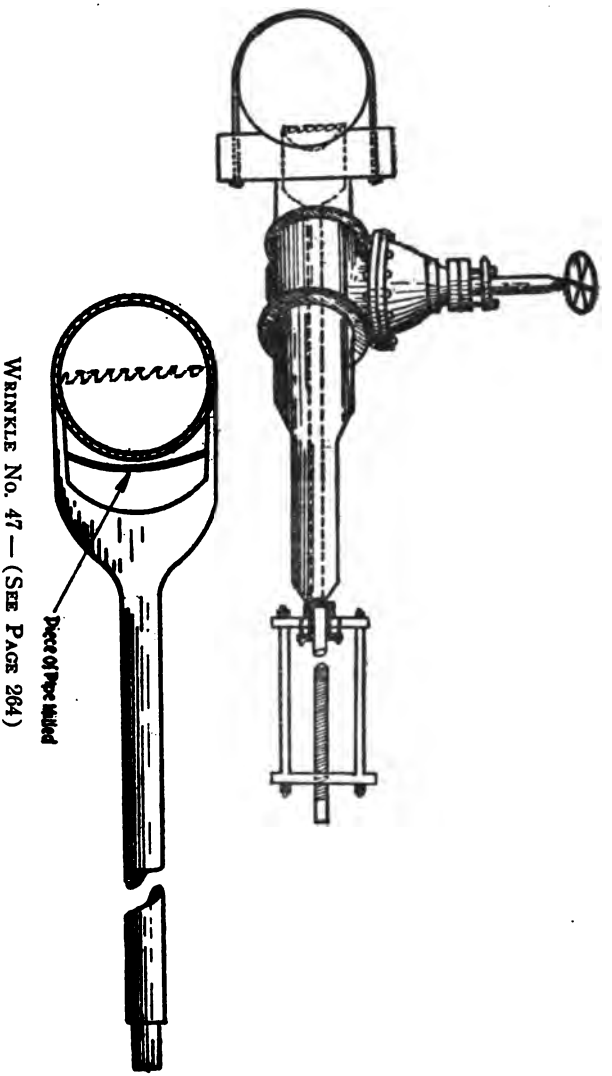

WRINKLE No. 47 — (SEE PAGE 264)

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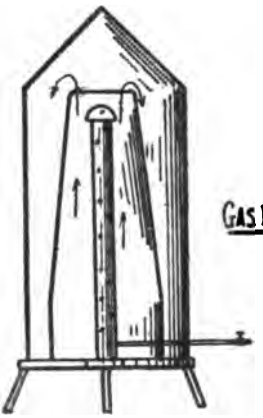
WRINKLE NO. 50

GAS HEATER FOR WAREHOUSE, ETC.

DESIGNED BY E. F. MCDANIEL, DISTRICT SUPERINTENDENT WICHITA NATURAL GAS COMPANY



GAS HEATER FOR WAREHOUSES ETC.

Bottom

Designed by E.F.M. Daniels

This stove is made of two pieces of junk pipe and is found to be very safe and a good heater.

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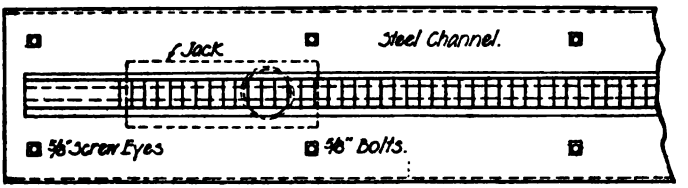
WRINKLE NO. 51

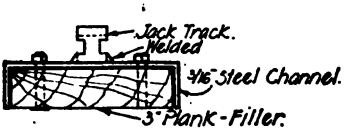
TO OVERCOME TROUBLE WITH BARRETT PIPE JACK TRACK

J. P. STRICKLER, THE COLUMBUS GAS & FUEL CO., COLUMBUS, O.

Construction men who have been having trouble with barrett pipe jacks will find the following little wrinkle useful. We have found the same to be a big improvement on our work.

An excellent way to overcome trouble with your barrett pipe jack track is to have same welded to a 10" channel iron. This





CROSS-SECTION.
BARRETT JACK TRACK.

WRINKLE No. 51

will prevent track from springing out of shape and breaking in two. Put a couple of screw eye bolts in end of your jack board or iron, so you can lift your jack out of trench, as you will find it pretty heavy. The extra weight is a good thing, as it assists in holding your jack bolt to bottom of trench. It will assist you greatly in driving various size pipes, to just turn the same with a pair of tongs, while you are driving with your jack.

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WRINKLE NO. 52

A NEW PROCESS FOR PLUGGING OFF BOTTOM WATER UNDER OIL SANDS IN A PRODUCING OIL WELL

J. J. SCHUBERT, SUPT. MUDDLING DEPT., EMPIRE GAS & FUEL CO., AUGUSTA, KANSAS

It is a known fact that the great majority of oil wells in most fields, are drilled too deep into the oil sands, thereby penetrating the water-bearing sand which lies below the oil-bearing strata.

The cause for drilling so deep into the oil sands can be attributed to the producers' expecting a greater increase of oil production by further penetration, only to find that the water sand has been reached.

When a producing well is drilled into the water sand, the water pressure is released, and therefore raises up in the hole, where it is bound to follow the least resistance, leaving the oil-bearing sand above it exposed to the water pressure. In the case of a 2500 foot hole it has been found to rise to a 1400 foot level, equal to a static water pressure of about 630 lbs.

This static water pressure of 630 lbs. upon the oil-bearing sand, not only retards the flow of the oil, but simply floods the oil-bearing strata with a water pressure, which, due to the static pressure, drives the oil back into the sand, as the static pressure of the water overcomes the pressure of the oil, hence the well is then termed a "water well" without any more oil production.

The old method of plugging bottom water off under the oil-bearing sand, (where the well was drilled into water) has been to concrete the bottom sand, using cement, also by driving lead plugs, wood pluds, iron, and various patent plugs. Most of these methods have not been successful

The cement process has been very successfully used in a great many places but only where the sands are close. Where the sands are loose and soft, cementing has not proved to be successful.

In the soft and loose sand wells, the following process of mud fluid has been successfully used in a large number of wells.

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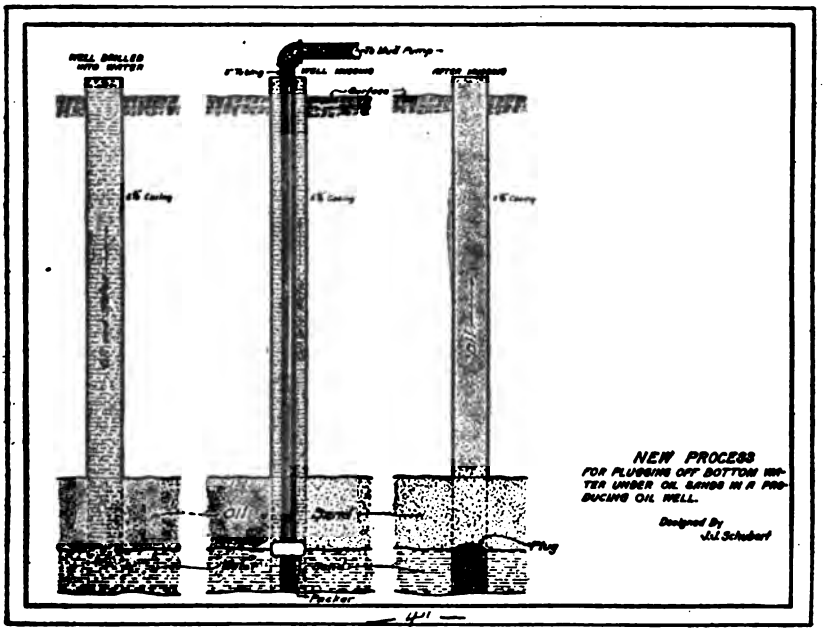
This process being originated through various experiments made by the Muddling Department of the Empire Gas & Fuel Co., of Kansas, under the supervision of the writer in the Butler County, Kansas, fields.

For example: A 2500 foot well was drilled into the oil sand 60 feet. Now, in drilling the last 10 feet of a total depth of 2460 feet, the production ceased flowing, and decreased materially, and the well showed that it was making water in large



WRINKLE No. 52 — (SEE PAGE 268)

quantities, which denoted that the last 10 feet evidently was a water sand, (the latter can be determined by observing the sand cuttings in most cases) and the water pressure had raised the water above the oil sand, and retarded the oil production.

By running 2-inch or 3-inch tubing with a common tubing packer set at 2450 feet, with 10 feet of perforated anchor on the bottom of the packer, it will pack off the water sand under the rubber of the packer, and then start pumping a light mixture of

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mud fluid on the inside of the tubing, which will then enter the water sand under the packer through the perforated pipe.

It is necessary to gradually increase the gravity of the mud, after pumping is started, which finally should attain as high a gravity as is possible to handle through a mud pump.

By introducing the mud directly into the pores of the water sand under pressure, it drives the water back, and the mud fluid follows up the water, filling, and sealing up the pores.

After all the mud is pumped into the sand that is possible to induce with the working pressure of a mud pump, you will notice a pressure on the sand of about 450 to 600 lbs., which, when first shut in will gradually decrease, the latter is due to the pressure of the mud fluid gradually forming its way into the sand while under pressure, barring minor leaks in the tubing, fittings, etc., It has proved very practical to hold as high a pressure on the water sand, after it is packed, by simply starting up the pump at intervals as the pressure decreases. In time the sand will become packed to such a point, that the decrease of pressure will be very slight.

Now, having the water sand mudded off under pressure (for instance, 600 lbs.), the well is now ready to have the plugs inserted to hold in the mud pressure.

On account of the mud in the water sand being at 600 lbs. pressure, it is necessary to apply some greater pressure on top of the packer before trying to pull the tubing and packer, so as to overcome the 600 lbs. mud pressure to keep the mud from coming up the hole. The inside of the casing, on top of the packer, should be filled up with water in order to acquire a static water pressure which is greater than the mud pressure under the packer.

For instance, supposing that the inside of the casing, or the top of the outside of the packer, was filled clear to the top of the hole with water, this would make a column of water 2450 feet, equal to about 1100 lbs. static pressure, on top of the packer. This, you see, would easily overcome the mud pressure which is on the water sand under the packer. Now then, the tubing and packer can be pulled out without any danger of the mud pressure being released to come up the hole.

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In preparing this mud fluid it is necessary to screen the mud so there are no stones, trash, hemp, etc., in the mud filler to clog the perforation.

After the tubing and packer is pulled out, the inside of the casing is to be kept filled with water in order to be able to drive plugs without releasing the mud pressure.

Limit plugs, which are made of wood with lead pipe tops, are then driven on the bottom, and sufficient plugs are put in so that the top of the plugs when driven, will be 10 feet off the bottom, the same place where the packer was set. After the plugs are properly driven, the well is then ready to be tested by bailing out the water, and cleaning out to the bottom. Let it remain idle for a day or two in order to ascertain if the water is shut off and to see if plugs are tight. This can be accomplished by a good bailing test.

Where the sands are very hard, it is useless to try to pump mud into the water sand, however, in such a case, cementing would be in order, as it has been proven that cementing can be successfully done in a hard, tight sand, as previously mentioned.

The advantage in plugging off loose water sands with the mud fluid process, is that the mud is driven back into the water sand, or pores, and displaces the water with mud, while if the cementing process was used, it would merely form a plug at the bottom, the size of the hole drilled, and there would be nothing to prevent the water from coming up and around the sides of the cement plug where the *sands are loose.*

In most of the oil sands there is generally a hard formation, or shell, between the oil pay and the water sand, which serves as a bond dividing the sands. However, it has been known that some oil sands run into a water sand without any breaks or shell between them.

As to how far the mud fluid will penetrate a water sand, depends entirely on the tightness of the sand. The writer has had the experience of demonstrating that the mud fluid in one particular well in Butler County, Kansas, has penetrated as far as 2100 feet.

To explain this item I want to say that there was a well drilling about 2100 feet away from a completed oil well, in which

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the bottom water was being mudded off, and after pumping mud for several days into the water sand, we discovered that the drilling well 2100 feet away was drilling into the oil sand. They drilled through the same and drilled into mud, and the mud was raising up in the hoe, due to being under pressure.

In most all cases where the water is securely plugged off and the hole is free from water, I find that the oil production has increased to a great extent.

WRINKLE NO. 53

WHAT THEY MUST DO SHOULD GAS FLOW STOP

H. H. HALL, THE OHIO FUEL SUPPLY CO., COLUMBUS, OHIO

In our smaller towns, where we would not be justified in employing a man for that town only, we pay a small amount to someone, generally the village blacksmith or store keeper for changing the chart once a week on our regulator.

In order to impress on them what to do in an emergency, the following notice printed on 10″ x 14″ cardboard and framed has been hung in all regulator houses.

IF, FOR ANY REASON THE SUPPLY OF GAS SHOULD STOP

1st. Shut the gate ahead of low pressure regulator.

2nd. Notify EVERY consumer to turn off all stop cocks at lights and fires, and in case a consumer is not at home, shut off gas at curb or meter.

3rd. When pressure again is sufficient in main line, open gate slowly and allow gas to go into town lines. Be SURE everything is safe.

THE OHIO FUEL SUPPLY CO.

WRINKLE NO. 54

STEEL FORM FOR CEMENTING PIPE LINE

ED. CANNY, KANSAS NATURAL GAS CO., COLUMBUS, KANSAS

(See drawing on page 273)

The drawing which Mr. Canny has submitted seems to need no description. He has used the form with great success. — EDITORS.

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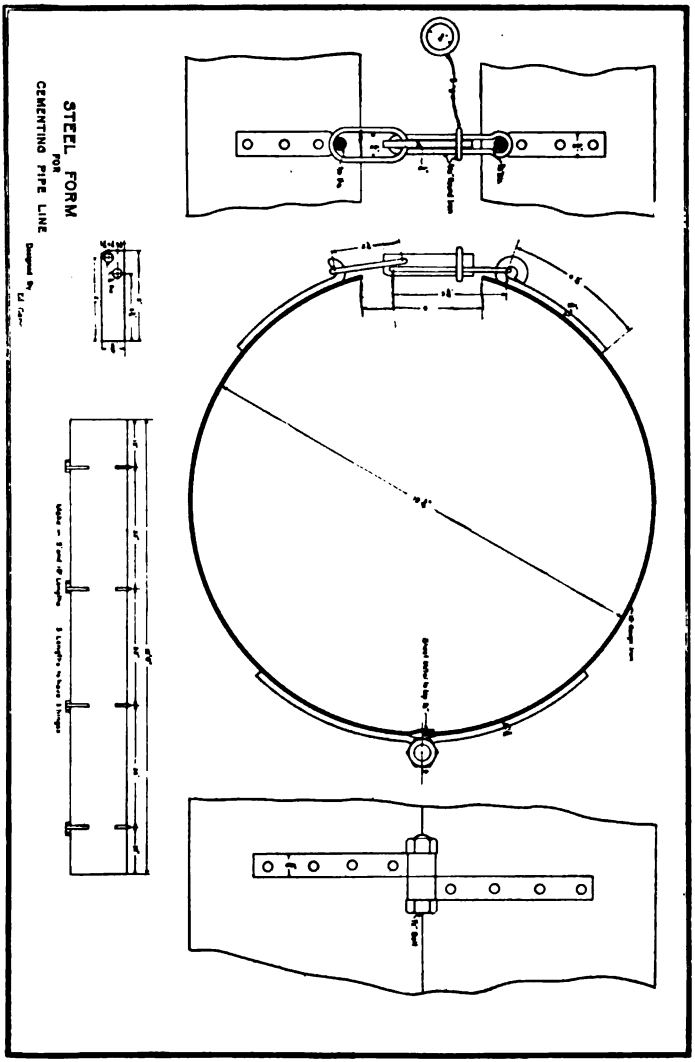

WRINKLE No. 54 — (SEE PAGE 272)

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WRINKLE NO. 55

"ALWAYS USE YOUR HEAD"

E. S. ROONEY, PITTSBURGH, PA; I. L., LEHMAN, DAYTON, OHIO, AND F. R. HUTCHINSON, CLEVELAND, OHIO

After the Natural gas men had visited Niagara Falls last year, many excuses, some even plausible, were given as to why

they failed to gather for the usual group photograph. Here we have one of them.

On the most reliable authority (themselves) it is said the men who sent in the accompanying drawing, were so fascinated by the transportation efficiency of a certain daughter of Sunny Italy, they actually forgot all about the opportunity offered to have their own handsome shapes go down to posterity. But, be that as it might, the fact remains that these men sent this sketch to the Wrinkle Depart ment, with the explanation that Mr.

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Rooney made the sketch, while Mr. Lehman and Mr. Hutchinson talked of how they would run the railroads if ——.

It is also reliably reported (not by themselves) that they sat up as late as 9:15 o'clock one night (convention time) telling one another just why they should send the sketch to the wrinkle editors. But when it arrived they simply wrote: "Always use your head." Thus the explanation.— EDITOR.

WRINKLE NO. 56

CARD TIRE RECORD

E. C. EGAN, MANUFACTURERS LIGHT & HEAT CO., PITTSBURGH, PA.

The idea shown on the card is to carry the records relative to different makes and sizes of tires, using a card for each make and size, showing date received, Serial Number, and space for the speedometer readings as the changes occur while the tire is in use.

The figures, shown just above the off readings, denote the mileage, and we carry this in totals. In this manner, the last figures show the total mileage in each case. In this manner it will be possible, at a glance, to note the total mileage on any particular tire. We have found this system very simple, yet very complete for such information we have required on this plant.

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TIRE RECORD.

MAKE "GOODYEAR". SIZE 35" x 5".

Date Rec'd	Serial No.	On	Off	On	Off	On	Off	On	Off	On	Off
		Mileage	5000		5300						
5/6–18	B187688	3500	8500	9500	9800						

WRINKLE No. 56 — (SEE PAGE 275)

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WRINKLE NO. 57

CONNECTING INTO CAST IRON MAINS WITH RUBBER PACKED COUPLINGS

M. W. WALSH, LOUISVILLE GAS & ELEC. CO., LOUISVILLE, KY.

The sketch herewith describes a method which has been used here and elsewhere in connecting into cast iron mains with rubber packed couplings.

The object is to make the connection with the usual standard fittings of the kind on hand quickly.

Holes for gas stopper are drilled in the cast iron pipe.

Cut pipe the required distance to allow for tee and steel pipe nipple all to the bolted together above ground if desired.

The ends of cast iron pipe to be smoothed off with a file, taking off the rough places far enough to allow for center ring, rubber and followers.

Cut out lugs and ream out center ring about 1/16" of metal on one end which goes over cast iron pipe. These center rings whether of steel or cast iron are placed in a lathe and turned out to allow for the difference in diameter of steel and cast iron pipe.

The metal cutting of center ring is seldom over 1/16" which still leaves plenty of metal in ring for low pressure gas work. I have made these connections with satisfaction.

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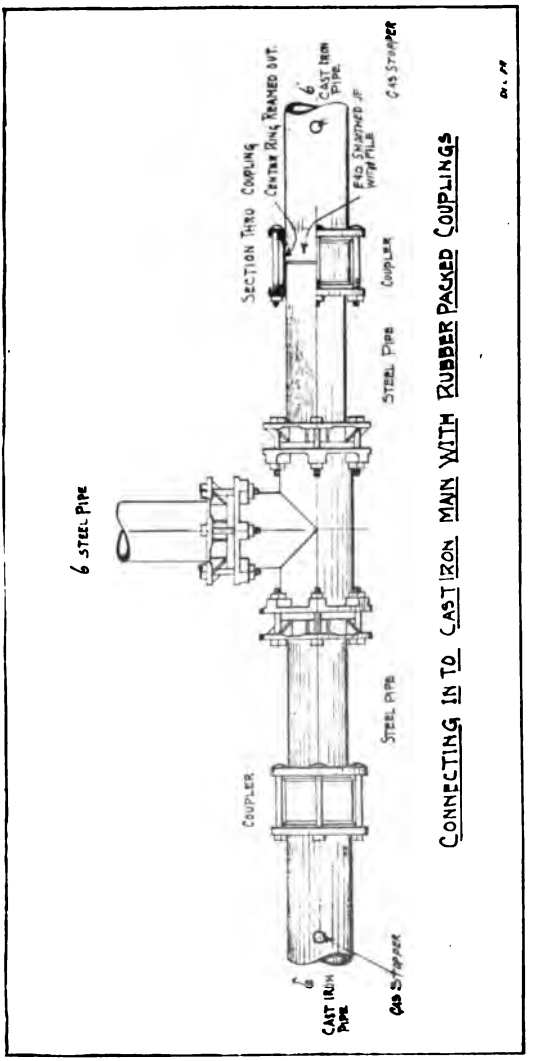

WRINKLE No. 57 — (SEE PAGE 277)

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WRINKLE NO. 58

MINIATURE TEST ABSORBER

T. H. KERR, ENGINEER, THE OHIO FUEL SUPPLY CO.,
COLUMBUS, OHIO

The accompanying cut illustrates a miniature test absorber for testing Natural Gas for gasoline content. This absorber

WRINKLE NO. 58

was designed to secure a minimum of size combined with extreme accuracy and it has proven to be better than we had hoped. It has a capacity of 1000 cc of mineral seal oil and will pass 100 cu. ft. of gas per hour without carrying oil over. It

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is constructed of aluminium and seamless tubing, is 20½ inches long and 31 inches in diameter, weighing 9½ pounds.

Valuable assistance was given me in this design by H. T. Boyd and P. McDonald Bidison both of this company.

WRINKLE NO. 59

ORIFICE METER SLIDE RULE

T. H. KERR, ENGINEER, THE OHIO FUEL SUPPLY CO., COLUMBUS, OHIO

The drawing on p. 71 shows the design of an Orifice Meter Slide Rule. It is designed to give the total hourly delivery of gas through an Orifice Meter with one setting of the slide. The runner is arranged to carry supplementary scales by the use of which corrections for pressure base and specific gravity can be readily read direct with one setting of the runner.

Instructions for operating Orifice Meter Slide Rule:—

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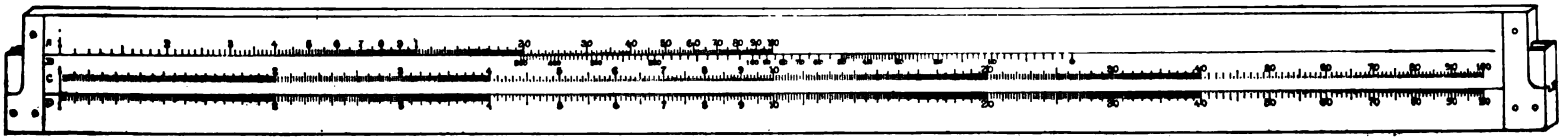

INSTRUCTIONS FOR OPERATING ORIFICE METER SLIDE RULE.

Set under Diff. pressure (scale A), Static pressure (scale B), under the coefficient (scale C), read the delivery. If the coeff. is hourly coeff. delivery will be cubic feet per hour and the same is true of the fifteen minute coeff.

						To Left of 10 Result	To Right It Has
Whole Coeff. Between	1	and 10	Decimal Coeff.	.001	and .01	has 2 figures.	3 figures.
	10	" 100		.01	" .10	3 "	4 "
	100	" 1000		.10	" 1.	4 "	5 "
	1000	" 10000		1.	" 10.	5 "	6 "
	10000	" 100000		10.	" 100.	6 "	7 "
	100000	" 1000000		100.	" 1000.	7 "	8 "

WRINKLE No. 59

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WRINKLE NO. 60

ON METER READERS' INSPECTION REPORTS AND PLANT UPKEEP

C. L. MAY, CHIEF INSPECTOR, LONE STAR GAS COMPANY, FORT WORTH, TEXAS

A good system of keeping a plant in condition could well include a meter reader's inspection report something like shown in drawing:

	Meters									Curb to Meter					
	Bad, Dead or Slow	Not Sealed	Leaky	Idle	Dial or Glass broken	Sets out of line	Not easily accessible	Sets outside without Cover	Under capacity needed.	Curbbox not on Grade	Curbbox broken	Stop, Plug or Cap not sealed	Tees or U's in service	Service Opening not plugged	Leaks
Name and Address															

WRINKLE No 60

Of course there are many other defects that can be reported but the above are, I believe, the most common ones; too it takes very little time to discover any one of them.

It appears that especially in the larger plants a meter reader's value is decidedly underestimated. I have hired men who have spent as much as four years previous, reading meters in a city having 20,000 consumers, and found they knew very little about the gas business and even very little about the meter itself. In fact so often meter readers are not aware that one-half the defects in the above list are really defects. They have never learned that. I have in mind a large plant in the middle west where a few years ago college boys were being hired to read the meters on a basis of one cent each.

In something like fifty instances, where connections were found ahead of the meter by inspectors, they should have been seen by the meter reader. It was indeed surprising the hundreds

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of defects that were seen at a glance by the inspectors who came after them.

I have worked on inspection in a plant where rewards were being paid meter readers for turning in certain bad conditions, but we found this plan to have disadvantages, inasmuch, as they were reporting only these certain conditions and ignoring the others.

By instructing meter readers in gas distribution, etc., and by appreciating their value, not overcrowding them with meters for one day's reading and by making them, to a large degree, meter inspectors as well as meter readers, their part toward the upkeep of a plant could be materially increased. Why not do it?

C. L. MAY, *Chief Inspector.*

WRINKLE NO. 61

RUBBER BY-PASS CONNECTION

E. J. EGAN, AGENT, 119 MILLBRIDGE ST., PITTSBURG, PA.

Herewith is a sketch which shows Wrinkle in use on this plant, which consists of re-inforced rubber by-pass connection. The idea is not entirely original with me, but has been used to very good advantage here in a great many cases. The principal points, are that it is always ready for use, made of rubber it is more flexible, and less liable to be broken off while feeding and putting the consumers out of gas, can be used or reduced to any size necessary, and can be worked in close place where it might be impossible account of traffic to install iron pipe connection. Saves time and material, and we have found it very handy and convenient in many cases in feeding "dead ends" for connection work on a low pressure system without interruption to our service.

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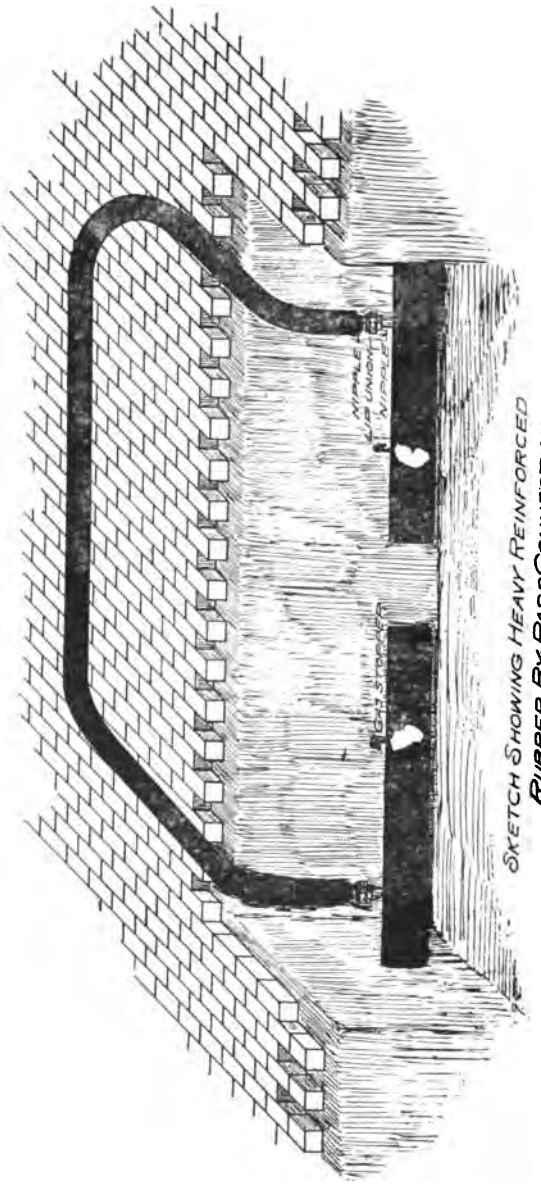

SKETCH SHOWING HEAVY REINFORCED RUBBER BY-PASS CONNECTION. MAY 17, 1918.

WRINKLE No. 61 — (SEE PAGE 283)

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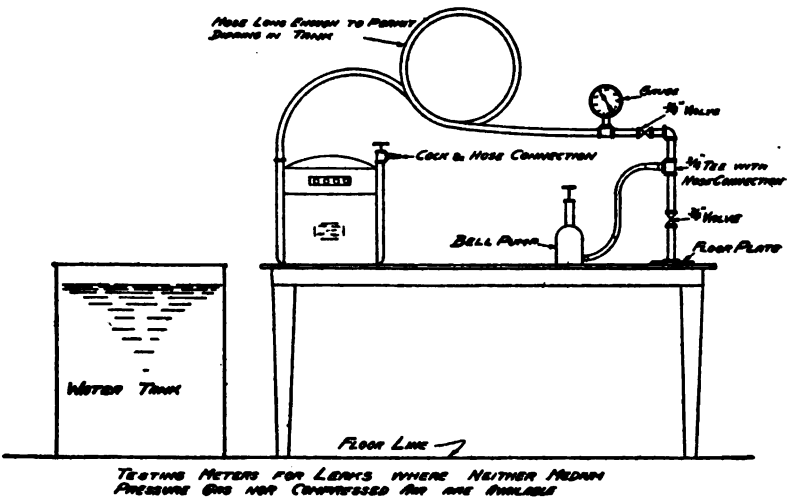
WRINKLE NO. 62

TO TEST METERS WITHOUT GAS OR AIR

L. G. MAY, INSPECTOR, LONE STAR GAS COMPANY,
FORT WORTH, TEXAS

In testing meters for leaks where neither medium pressure gas nor compressed air are available, the plan shown in the drawing could be used successfully. In this manner a double test


Hose Long Enough to Permit Dipping in Tank
Gauge
¾" Valve
Cock & Hose Connection
¾" Tee with Hose Connection
¾" Valve
Bell Plug
Floor Plate
Water Tank
Floor Line
Testing Meters for Leaks where Neither Medium Pressure Gas nor Compressed Air are Available

WRINKLE NO. 62

can be made for leakage by dipping in water and also noting the drop, if any, on the gauge. The sketch is, I believe, self-explanatory.

WRINKLE NO. 63

TO GUARD AGAINST PRESSURE BEING INCREASED ON LITTLE GIANT REGULATORS BY CONSUMER

C. L. MAY, CHIEF INSPECTOR, LONE STAR GAS COMPANY,
FORT WORTH, TEXAS

This can be accomplished by drilling small hole through set screw and through one of the small bolts above diaphragm top;

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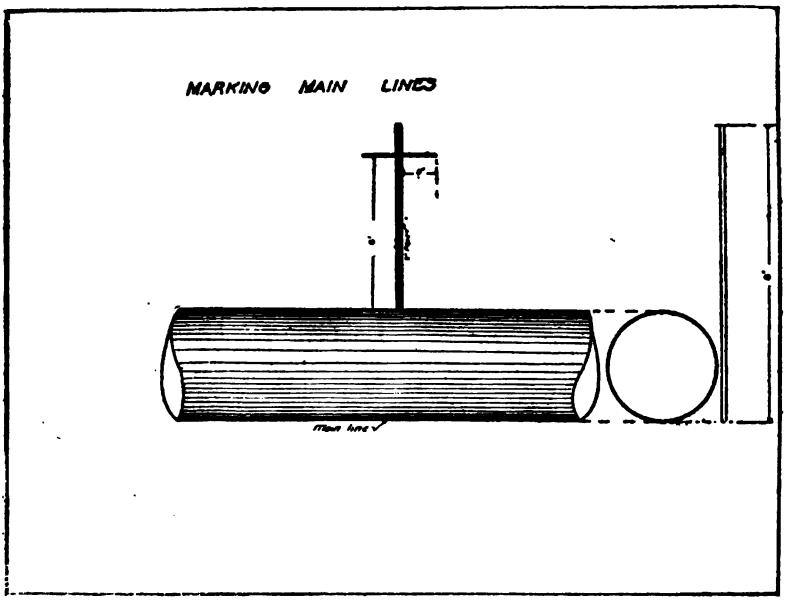
inserting copper wire through both holes and sealing ends with lead.

WRINKLE NO. 64

MARKING MAIN LINES

C. L. MAY, CHIEF INSPECTOR, LONE STAR GAS COMPANY, FORT WORTH, TEXAS

Present systems of marking main lines such as painting fence posts white, daubing paint on the side of trees, etc., have often been found faulty, inasmuch as the direction is not easily



WRINKLE No. 64

kept, where the next post can not be seen, and unless the markers are directly over the line it is very difficult to follow.

The following method would be found very satisfactory: Place a two-inch pipe, painted white, at fence lines and at every turn in the line, install it directly over the main, allow it to ex-

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tend about six feet above the ground and have a small rod set in the top to denote the direction in which the line is running.

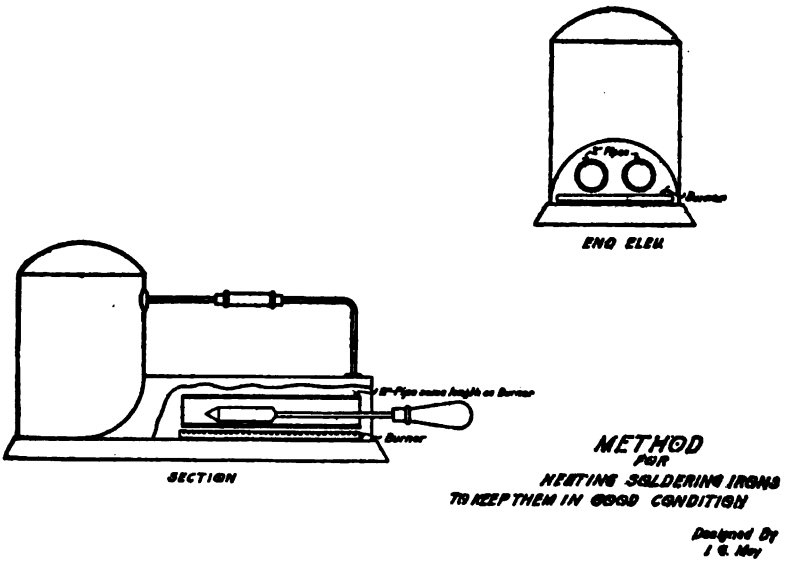
In the south and west where fields are exceptionally large it would be best to install the markers also in the center of the large fields and where the line runs through woods, etc., markers should be placed at short distances.

WRINKLE NO. 65

A GOOD METHOD OF KEEPING SOLDERING IRONS IN CONDITION

L. G. MAY, INSPECTOR, LONE STAR GAS COMPANY,
FORT WORTH, TEXAS

By placing a piece of two-inch pipe in the furnace the same length as the burner and putting the iron inside it for heating



WRINKLE NO. 65

the flame plays directly on the pipe instead of the iron. It will be found that the iron will heat almost as quickly as it will when exposed to the flame, will stay cleaner, will remain tinned a greater length of time and will last longer.

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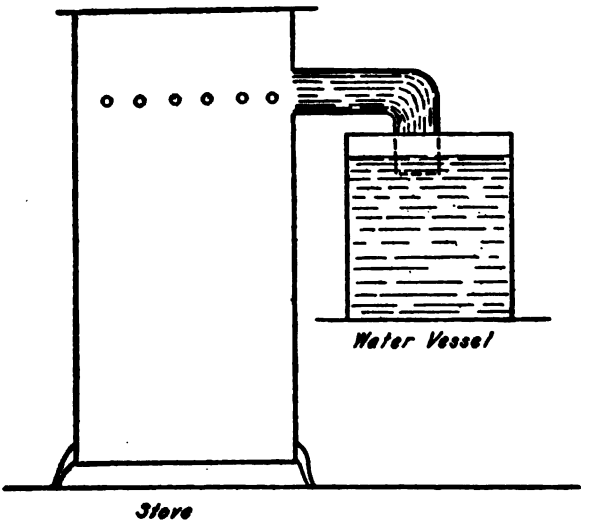
WRINKLE NO. 66

HERE'S ANOTHER IDEA ON HOW TO DO AWAY WITH "SWEATING"

L. G. MAY, INSPECTOR, LONE STAR GAS COMPANY,
FORT WORTH, TEXAS



WRINKLE NO. 66

To keep windows from sweating where gas is used and the stove not flue connected, put an elbow on the flue connection turning it down. Seal the open end in a vessel of water.

MR. W. RE BROWN, Editor of the Wrinkle Department, then said:

Mr. President and Gentlemen:

This year the good gas men of the country have contributed sixty-six War Time Natural Gas Wrinkles. There are fifty-eight in the printed pamphlet which has been distributed among the membership, and eight that were received just a little too late to get into the prepared book.

We were a trifle late in getting after the Wrinkles this year, owing to various obstacles, but we were helped out con-

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siderably by the different Gas Journals. The *Natural Gas Journal*, the *Gas Record* and the *Gas Age* gave us considerable publicity, and I believe they were responsible for bringing in a good many Wrinkles.

Some of the Gas Companies go to considerable trouble in their efforts to assist us in our work. I do not like to name Companies, but I would like to call out the various Gas Companies who have assisted us, and to name the good ones, and then name the bad ones, from the Wrinkle man's standpoint. But I simply want to thank those who have worked so hard in assisting us, and to thank the individual members of the organizations of these Companies who have contributed these Wrinkles.

Many of the Companies appoint a man in their organization to get these Wrinkles and to forward them to the Wrinkle Editors. To these Companies and to these men I have nothing but words of praise. I thank them most heartily.

It is rather difficult for a man by correspondence to get to the men who actually have the new ideas. I feel that the men who are working steadily, and who are doing the actual hard work, and from whom we may expect new ideas, have not the time to prepare them for submission to the Editors. A great many of them are fitters and men working on pipe lines and in other departments of the Gas industry, and perhaps feel that they cannot get up a Wrinkle just in proper shape. They hesitate to send in a Wrinkle in a manner in which they think it would not be quite up to the standard from a literary standpoint; but if each Company would appoint a man, — and appoint him right now when you go back home, — to get together these Wrinkles, and to get them together in time enough so that you can have a draftsman whip them into shape, it will be a great assistance to the editors of this department. Many of them no doubt feel that they do not possess the necessary education to do it as it should be done, and they fear they will be ashamed to see it in print. I think we could gather a good many new ideas if you would follow the suggestion just made

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of appointing someone as soon as you get back home whose duty it would be to look after this work.

This year a great many of the men have been called to the colors; and that is about the only excuse I will accept from a man for not contributing. Then in their places are a lot of new men coming in, and these men naturally have a little reluctance in their minds in attempting to contribute new ideas when they may not be fully familiar with their new work. But if you will just help those new fellows and encourage them and get them to thinking of the many short cuts and new ways of doing things, they will catch onto it very quickly, and as a result we will all receive the benefit of new ideas in the practical part of the work. I think that is the way that the Wrinkles will do the most good. Then through this department we can all get the benefit of this new thought and this new endeavor, so that next year we can have a Wrinkle Department of which we may all be proud.

I just simply want again to thank everyone who contributed to the Wrinkle Department this year, and to ask all of you to get busy for the work of the coming year. I do not know whether Mr. Diescher is here or not. If he is, I would like him to say something about the men in the west. They have contributed liberally, as they always have contributed.

If Mr. Diescher is not here, I would like Mr. Shannon to say a word, because Mr. Shannon was Assistant Wrinkle Editor two years ago, and he is still a great Wrinkle Booster. I thank you. (Applause.)

PRESIDENT GUFFEY: Mr. Diescher does not seem to be present. Is Mr. Shannon present? If so, we would be glad to hear from him.

MR. O. K. SHANNON: Mr. President, and Gentlemen: I have an idea, how the Wrinkle Department could be made more effective. I have tried out a plan, although I have not accomplished very much yet. I have offered a ten dollar reward to my own employes for the best Wrinkle that they would submit to me. I was the judge, the jury, and had charge of the ten dollars. (Laughter.) I have not accomplished much, but I have an idea though that if every Manager or every employer would

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offer, say a five dollar reward, or a ten dollar reward for the best Wrinkle or the best idea that could be submitted to the Manager or the employer, it would prove a great incentive in the production of new ideas and new Wrinkles to be incorporated into the report of the Wrinkle Committee. The men can keep these Wrinkles and submit them at the annual meeting to The Natural Gas Association, and if they win the prize, of course it will be turned over to the fellow as a reward for his efforts.

I served two years as Assistant Wrinkle Editor. I know something about their troubles. I feel that every Manager of every Gas Company that I know of,—myself and all others,—are too negligent about it. It is an awful job if you do not get proper help. It is a comparatively easy job if you do have help.

Mr. Brown never had any more sense than to work, and he just works harder all the time, but the result of his hard work is demonstrated by the excellent book of Wrinkles submitted.

I believe if the Managers of the various Companies would offer that little reward to their own organization, it would help out amazingly and would lighten the great labor that now rests upon the editor and his assistant. I thank you. (Applause.)

PRESIDENT GUFFEY: The Chair would like to entertain a motion that the report of the Committee on Wrinkles be received and ordered filed and published as heretofore; and that Mr. Brown as Editor and Mr. Diescher as Assistant Editor be continued in their respective positions for the ensuing year.

MR DONALD MCDONALD: I make that motion, Mr. Chairman.

MR. FRANK L. CHASE: I second it.

And thereupon, on motion duly seconded and carried, the report of the Wrinkle Department was received, ordered filed, spread upon the minutes and published in the proceedings.

PRESIDENT GUFFEY: We will receive the report of the Nominating Committee, of which Mr. W. Y. Cartwright is Chairman.

Mr. William Y. Cartwright then submitted the following:

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REPORT OF NOMINATING COMMITTEE.

Mr. President, and Gentlemen: In the past your Nominating Committees have followed the practice of preparing a slate and presenting it to the Convention, nominating the exact number of men to fill the offices of the retiring officers.

This practice, while it has been satisfactory in the past, has caused some friction. Therefore your committee has deemed it advisable to change it, and to present for your consideration two tickets, one designated as Ticket No. 1, and the other designated as Ticket No. 2. These tickets have been picked from the men who have been long in the service of the Association, and prominent in the industry. You may rest assured that with the election of either ticket the affairs of the Association will be carried on as ably and as well as they have in the past. Shall I read the two tickets, Mr. President?

PRESIDENT GUFFEY: You will do so, if you please.

MR. WILLIAM Y. CARTWRIGHT: The tickets are as follows:

TICKET NO. ONE.

For President:—Kay C. Krick, Logan Natural Gas Co., Columbus, Ohio.

For Vice President:—Bert C. Oliphant, Iroquois Natural Gas Co., Buffalo, N. Y.

For Secretary and Treasurer:—David O. Holbrook, Pittsburgh, Pa.

Directors:—T. O. Sullivan, Manufacturers Light and Heat Co., Pittsburgh, Pa.
R. W. Gallagher, East Ohio Gas Co., Cleveland, Ohio.
Leslie B. Denning, Lone Star Gas Co., Texas.
R. G. Altizer, United Fuel Gas Co., Charleston, W. Va.
Edward D. Leland, Philadelphia Co., Pittsburg, Pa.
Francis P. Fisher, Wichita Natural Gas Co., Bartlesville, Okla.

TICKET NO. TWO.

For President:—Kay C. Krick, Logan Natural Gas and Fuel Co., Columbus, Ohio.

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For Vice President:—Alfred J. Diescher, Empire Gas and Fuel Co., Bartlesville, Okla.

For Secretary and Treasurer:—Thomas C. Jones, Delaware, Ohio.

Directors:—Timothy O. Sullivan, Manufacturers Light and Heat Co., Pittsburgh, Pa.
Ralph W. Gallagher, East Ohio Gas Co., Cleveland, Ohio.
Leslie B. Denning, Lone Star Gas Co., Texas.
R. G. Altizer, United Fuel Gas Co., Charleston, W. Va.
Edward D. Leland, Philadelphia Co., Pittsburgh, Pa.
Francis P. Fisher, Wichita Natural Gas Co., Bartlesville, Okla.

Respectfully submitted,

W. Y. CARTWRIGHT, *Chairman*
A. A. ARMSTRONG
ARTHUR BOOTH
Nominating Committee.

PRESIDENT GUFFEY: Gentlemen, you have heard the report of the Committee on Nominations. It seems to me the best way to have the election is for the Chair to appoint two tellers to come up here, and upon the taking of a standing vote they can count the votes cast for Ticket No. 1, and then count the votes cast for Ticket No. 2, and to those men standing in the rear of the room, we could have them raise their hands to indicate how they want to vote. If that is agreeable, I will appoint on that Committee as Tellers J. C. McDowell and John M. Garard, and I would ask them to come up and take a position on the platform so that they can readily see how each member votes.

MR. JOHN M. GARARD: Mr. President, I don't know about the matter of efficiency, but you have appointed the two handsomest men here. (Laughter.)

After the two tellers had taken a position on the platform, President Guffey said:

All those who are in favor of the election of Ticket No. 1 will stand and remain standing until counted, and those who are in the rear of the room will kindly hold up their right hands.

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Those voting for Ticket No. 1 then did as requested while the vote was being counted by the tellers.

PRESIDENT GUFFEY: Just be seated now, will you please.

All those in favor of Ticket No. 2 will please rise, and those in the rear of the room desiring to vote will please raise their right hands.

Those voting for Ticket No. 2 then did as requested while the vote was being counted by the tellers.

MR. JOHN M. GARARD: Ticket No. 1 seems to have it.

I move you, Mr. President, that the nomination of Ticket No. 1 be made unanimous.

MR. DONALD MCDONALD: I second the motion.

PRESIDENT GUFFEY: Gentlemen, you have heard the motion that the nominees as contained in Ticket No. 1 be elected unanimous to their respective positions.

And thereupon the above motion having been duly seconded, was unanimously carried.

PRESIDENT GUFFEY: I will appoint Mr. Garard, Mr. McDowell and Mr. Cartwright a committee to escort Mr. Krick, our newly elected president, to the Chair.

Mr. Kay C. Krick was then escorted to the chair amid a hearty round of applause.

PRESIDENT GUFFEY: Gentlemen, I take great pleasure in introducing to you your next president, Mr. Krick.

Mr. Kay C. Krick, in assuming the duties as President of the Association, said:

Mr. President and Fellow-Members of the Natural Gas Association of America:—

I would be ungrateful indeed if I failed to acknowledge and to appreciate the very signal honor that you have conferred upon me, especially when I contemplate that splendid galaxy of ex-presidents, leaders in our industry who have gone before, and particularly the brilliant administration of my immediate predecessor.

I have always been interested in the welfare of this Association since in 1906, becoming a member, and have taken great pleasure in noting its growth and progress. I have always felt

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that an Association like this, representative of a great industry needs co-operative effort. I realize that at the present time, with conditions in such an abnormal state, and with great tasks before us to be performed, we will probably be confronted with problems that will require the best thought and the best effort on the part of all of us in their final solution.

I do not want to keep you but for a moment. I merely wish to pledge you my best endeavors in so far as I am able to exert them in bringing success to our achievements, and to assure you that I will work towards that end earnestly, enthusiastically and to the best of my ability. But success in the final analysis depends always upon your assistance, your advice, your help, and I crave that much both for myself and my fellow-officers. I thank you. (Applause.)

MR. L. S. BIGELOW: Mr. President, before proceeding with the regular program, I want to say a word about what has been done for this Association for years past by one of its retiring officers.

This Association, of which I have been a member since its swaddling clothes days, has gone on year after year without interruption so far as a part of the executive work is concerned, and I am referring now to the type of executive work which is consecutive in many associations as it is in this Association. Presidents and presidents go, and we say, "The King is dead! Long live the King!" Time and again; but when it comes to the work of the Secretary, it is a type of work that goes steadily on from year to year, and we become so accustomed to receiving the services of the man occupying that position and saying that he is a good fellow and all that sort of thing, we forget that very frequently what that man receives from the Association does not compensate him for the amount of time and attention that he gives to his office and his duties. I say duties, because when he has assumed that office, he has assumed all the duties that go with it, and which he must perform whether he feels he is fully compensated in cash or not.

Now, in connection with this Association, having been a member for years, I want to say to Mr. Jones and of Mr. Jones a word or two. I want to say that Mr. Jones has done splen-

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did work for this Association. It has been productive work. The Association has grown during the period of Mr. Jones' tenure of office, and I want to say, if I may be privileged, from the Association to Mr. Jones — and I have not been asked to do this, but I want to do this voluntarily, because I know it is deserved, and more than deserved, and I want to say to Mr. Jones on behalf of the entire membership of this Association that we are exceedingly grateful to him for all the good work he has done. It has been manifold and it has been exacting and in many instances it has been difficult work to be performed. That he has done it well goes without saying, and I am going to ask the President for permission to offer a resolution, that a vote of thanks be extended to Mr. Jones, now as he is retiring from office in this Association, for the excellent work that he has done for so many years as our efficient secretary and treasurer.

MR. JOSEPH F. GUFFEY: I take pleasure in seconding the motion.

PRESIDENT KRICK: Gentlemen, you have heard the motion. Are there any remarks? Mr. Bigelow moves that a hearty vote of thanks be extended to our retiring Secretary and Treasurer, Mr. T. C. Jones, for the efficient services rendered by him to the Association.

The above motion having been duly seconded was then unanimously adopted amid applause.

MR. T. C. JONES: I certainly appreciate the kindly feeling extended by Mr. Bigelow and also thank you for the resolution just passed.

PRESIDENT KRICK: We will now have the report of the Committee on Memorials, of which Mr. Bigelow is Chairman.

Mr. L. S. Bigelow then read the following:

REPORT OF COMMITTEE ON MEMORIALS.

Mr. President and Fellow Members of the Natural Gas Association of America:—

It becomes the sad duty of your Committee to recount the deaths during the past fiscal year of this Association of several

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of those of this industry in the United States, who have, as members of this Association, and through their personal service to the field, become individually identified with this, one of the greatest of all industries, serving humanity.

While the names upon this Honor Roll of 1917-18 stand for varied types of industry and service, each of itself stands for that pre-eminent type, namely, Personal Service.

We recommend that the following names be spread upon the records of this Association for the current year as having finished their labors here, where theirs has been a work well done:

H. C. Reeser, Pittsburgh, Pa.;
Arthur M. Blinn, Erie, Pa.;
George P. Boothe, Bradford, Pa.;
W. G. Reel, Pittsburgh, Pa.;
C. E. Crawford, Pittsburgh, Pa.;
Hugh P. Brawley, Meadville, Pa.;
Peter M. Kerr, Kittanning, Pa.;
T. T. Vandergrift, Lancaster, O.;
S. J. Dill, New York, N. Y.;
M. G. Reynolds, Anderson, Ind.;
J. W. Stearns, Buffalo, N. Y.

Respectfully submitted,

LUCIUS S. BIGELOW,
MILT H. SAUL,
D. S. WAKENIGHT,
Committee.

PRESIDENT KRICK: Gentlemen, you have heard the report of the Committee on Memorials. What is the desire of the Convention?

MR. J. C. MCDOWELL: Mr. President, I move that the report be adopted by a rising vote.

MR. JOHN M. GARARD: I second the motion.

And thereupon the above motion having been duly seconded was unanimously adopted by a rising vote.

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PRESIDENT KRICK: Gentlemen, is there any further business? If there is no further business to come before the Association at this time, I will now entertain a motion to adjourn sine die.

And thereupon, on motion of Mr. Joseph F. Guffey, duly seconded by Mr. J. C. McDowell, and carried, the Thirteenth Annual Meeting of The Natural Gas Association of America adjourned sine die.

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APPENDIX

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OFFICERS

OF THE

NATURAL GAS ASSOCIATION OF AMERICA 1918-1919

PRESIDENT.

KAY C. KRICK.....Columbus, Ohio

VICE PRESIDENT.

BERT C. OLIPHANT.....Buffalo, N. Y.

SECRETARY AND TREASURER.

DAVID O. HOLBROOK.....Pittsburgh, Pa.

DIRECTORS.

A. A. ARMSTRONG, Pittsburgh, Pa.....	Term Expires 1919
JAMES W. MCMAHON, Toledo, Ohio.....	Term Expires 1919
CLIFTON W. SEARS, Wooster, Ohio.....	Term Expires 1919
JOHN H. MAXON, Muncie, Ind.....	Term Expires 1919
HARRY J. HOOVER, Cincinnati, Ohio.....	Term Expires 1919
GLENN T. BRADEN, Tulsa, Okla.....	Term Expires 1919
T. O. SULLIVAN, Pittsburgh, Pa.....	Term Expires 1920
RALPH W. GALLAGHER, Cleveland, Ohio..	Term Expires 1920
LESLIE B. DENNING, Pittsburgh, Pa.....	Term Expires 1920
R. F. ALTIZER, Charleston, W. Va.....	Term Expires 1920
E. D. LELAND, Pittsburgh, Pa.....	Term Expires 1920
F. P. FISHER, Bartlesville, Okla.....	Term Expires 1920

PAST PRESIDENTS.

* KERR M. MITCHELL.....	1906–1907
JESSIE C. MCDOWELL.....	1908–1909

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WILLIAM H. MCKENZIE..... 1910
JOHN M. GARARD..... 1911
ALEXANDER B. MACBETH..... 1912
MARTIN B. DALY..... 1913
ERNEST L. BRUNDRETT..... 1914
JAMES T. LYNN..... 1915
WILLIAM Y. CARTWRIGHT..... 1916
JOSEPH F. GUFFEY..... 1917–1918

PAST SECRETARIES.

JOSEPH H. DUNKEL..... 1906–1908
JAMES F. OWENS (Elected for)..... 1909
THOMAS C. JONES..... 1910–1918

PAST ANNUAL MEETINGS.

Organization—Kansas City, Mo., February 20, February 27 and March 20, 1906.

First ..... Kansas City, Mo., June 12 and 13, 1906
Second ..... Joplin, Mo., May 21, 22 and 23, 1907
Third ..... Kansas City, Mo., May 19, 20 and 21, 1908
Fourth ..... Columbus, Ohio, May 18, 19 and 20, 1909
Fifth ..... Oklahoma City, Okla., May 17, 18 and 19, 1910
Sixth ..... Pittsburgh, Pa., May 16, 17 and 18, 1911
Seventh ..... Kansas City, Mo., May 21, 22 and 23, 1912
Eighth ..... Cleveland, Ohio, May 20, 21 and 22, 1913
Ninth ..... St. Louis, Mo., May 19, 20 and 21, 1914
Tenth ..... Cincinnati, Ohio, May 18, 19 and 20, 1915
Eleventh ..... Pittsburgh, Pa., May 16, 17 and 18, 1916
Twelfth ..... Buffalo, N. Y., May 15, 16 and 17, 1917
Thirteenth .... Pittsburgh, Pa., May 22 and 23, 1918

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COMMITTEES, 1918-1919.

ADVISORY.

JOSEPH F. GUFFEY	Pittsburgh, Pa.
W. Y. CARTWRIGHT	Cincinnati, O.
J. T. LYNN	Detroit, Mich.
E. L. BRUNDRETT	Kansas City, Mo.
M. B. DALY	Cleveland, O.
A. B. MACBETH	Los Angeles, Cal.
J. M. GARARD	Columbus, O.
W. H. MCKENZIE	Kansas City, Kan.
J. C. MCDOWELL	Pittsburgh, Pa.

UNIFORM ACCOUNTING.

GEORGE W. RATCLIFFE	Pittsburgh, Pa.
H. V. SHULTERS	Cleveland, Ohio.
R. H. BARTLETT	Pittsburgh, Pa.
W. R. HADLEY	Pittsburgh, Pa.
C. W. DOWNING	Cleveland, Ohio.
W. J. JUDGE	New York, N. Y.
J. B. TONKIN	Pittsburgh, Pa.
C. S. MITCHELL	Pittsburgh, Pa.
T. F. WICKHAM	Cincinnati, Ohio.
G. C. SCOTT	Columbus, Ohio.
L. A. SEYFFERT	Charleston, W. Va.
A. J. NEWMAN	Pittsburgh, Pa.
J. B. WIKOFF	Pittsburgh, Pa.
W. B. S. WINANS	60 Wall Street, New York.

CONSERVATION.

A. J. DIESCHER	New York, N. Y.
I. C. WHITE	Morgantown, W. Va.
J. H. MAXON	Muncie, Ind.
J. B. CORRIN	Pittsburgh, Pa.
F. M. TOWL	New York, N. Y.

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JOINT COMMITTEE ON ELECTROLYSIS.

F. M. TOWL ..... New York, N. Y.
W. J. BRODER ..... Columbus, O.
S. S. WYER ..... Columbus, O.

UNITED STATES BUREAU OF STANDARDS.

S. S. WYER, *Representative* ..... Columbus, O.

COMMITTEE ON AWARDS FOR WRINKLE DEPARTMENT.

F. W. STONE ..... Ashtabula, O.
A. P. DAVIS ..... Pittsburgh, Pa.
FRANK H. CRAWFORD ..... Columbus, O.

WRINKLE DEPARTMENT.

W. RE. BROWN, *Editor* ..... Columbus, O.
W. H. SEDBERRY, *Asst. Editor* ..... Houma, La.

WAR SERVICE COMMITTEE.

JOSEPH F. GUFFEY ..... Pittsburgh, Pa.
JOHN G. PEW ..... Philadelphia, Pa.
GEORGE W. CRAWFORD ..... Pittsburgh, Pa.
GLENN T. BRADEN ..... Tulsa, Oklahoma.
J. C. MCDOWELL ..... Pittsburgh, Pa.
W. Y. CARTWRIGHT ..... Cincinnati, O.
T. O. SULLIVAN ..... Pittsburgh, Pa.
E. P. WHITCOMB ..... Pittsburgh, Pa.

MEMBERSHIP COMMITTEE.

H. A. QUAY, *Chairman* ..... Pittsburgh, Pa.
W. L. MCCLOY ..... Pittsburgh, Pa.

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FINANCE COMMITTEE.

A. A. ARMSTRONG, *Chairman* ..... Pittsburgh, Pa.
J. H. MAXON ..... Muncie, Ind.
J. B. TONKIN ..... Pittsburgh, Pa.

COMMITTEE ON CONSTITUTION AND BY-LAWS.

HARRY J. HOOVER, *Chairman* ..... Cincinnati, O.
LESLIE B. DENNING ..... Pittsburgh, Pa.
T. C. JONES ..... Delaware, O.

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DIRECTORY OF MEMBERSHIP

(The date with each name is that of election to membership).

HONORARY MEMBERS.

Bailey, Edgar H. S......May 19, 1908
Professor of Chemistry, University of Kansas, 1101 Ohio Street, Lawrence, Kansas.

Bownocker, John Adams.....May 18, 1909
State Geologist of Ohio, Ohio State University, 185 Fifteenth Avenue, Columbus, Ohio.

Gould, Charles N.....May 17, 1910
Geological Engineer, 1218-19 Colcord Building, Oklahoma City, Oklahoma.

Harmon, Judson.....May 18, 1909
Lawyer, Cincinnati, Ohio.

Haworth, Erasmus, Ph. D.....May 21, 1907
Professor of Geology and Mining, University of Kansas, Lawrence, Kansas.

Sears, Clifton W.....February 27, 1906
Vice President and General Manager, Central Ohio Gas & Electric Company, Wooster, Ohio.

Sweetman, Michael M.....February 27, 1906
Secretary, New York Oil and Gas Company, 316 American Bank Building, Kansas City Missouri.

White, Israel C.....May 16, 1911
State Geologist of West Virginia, 141 Willey Street, Morgantown, West Virginia.

ACTIVE MEMBERS.

Abbott, D. E.....May 18, 1915
Director, Huntington Development and Gas Company, 928 Third Avenue, Huntington, West Virginia.

Abbott, E. D.....May 18, 1909
Manager, The Springfield Gas Company, 221 North Fountain Avenue, Springfield, Ohio.

Abell, H. C.....May 21, 1912
Engineer, American Light & Traction Company, 120 Broadway, New York, New York.

Abramovitz, A. L.....
Chemist, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Adams, C. H.....May 15, 1917
Field Foreman, United Natural Gas Company, Kane, R. F. D. No. 2, Pennsylvania.

Adams, Larmour.....May 21, 1912
Metric Metal Works, Tenth and Payne Avenue, Erie, Pennsylvania.

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Adams, W. H.....May 16, 1916
Agent, Logan Natural Gas & Fuel Company, 102 East Main Street, Ashland, Ohio.

Adams, William M.....May 16, 1916
Agent, Citizens Gas & Electric Company, 102 East Main Street, Elyria, Ohio.

Adolf, Peter P.....May 15, 1917
Agent, Lancaster, New York, Iroquois Natural Gas Company, Lancaster, New York.

Aggers, E. W.....May 15, 1917
Contractor, F. A. Aggers & Son, 145 Fraley Street, Kane, Pennsylvania.

Alberty, P. A.....May 15, 1917
Assistant Superintendent, The Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Alden, John Douglas.....May 21, 1912
Assistant Superintendent, United Gas Improvement Company, 83 Center Street, Waterbury, Connecticut.

Alexander, W. F.....May 18, 1915
Natural Gas Insurance, Clarksburg, West Virginia.

Allen, J. Foster.....May 18, 1909
District Foreman, Sinclair-Cudahy Pipe Line Company, P. O. Box 398, Drumright, Oklahoma.

Allen, S. S., Jr.....May 21, 1907
Assistant Secretary, Columbus Gas & Fuel Company, 135 North Front Street, Columbus, Ohio.

Altizer, R. G.....May 19, 1914
Vice President, United Fuel Gas Company, 1422 Kanawha Street, Charleston, West Virginia.

Amey, L. C.....May 19, 1914
Chief Engineer, Manufacturers Gas Company, Kane, Pennsylvania.

Anderson, E. J.....May 15, 1917
Superintendent, Texas Gas Company, Mexia, Texas.

Anderson, J. F.....May 16, 1916
Field Foreman, The Peoples Natural Gas Company, R. D. No. 1, Mayport, Pennsylvania.

Angle, J. E.....May 16, 1911
Superintendent, Fayette County Gas Company, 302 South Pittsburgh Street, Connellsville, Pennsylvania.

Apple, C. B.....May 15, 1917
12518 Clifton Boulevard, Cleveland, Ohio.

Applegate, H. L.....May 22, 1918
Land Agent, Carnegie Natural Gas Company, 816 Carnegie Building, Pittsburgh, Pennsylvania.

Ardizzone, Joseph.....May 21, 1912
President, The Ardizzone Company, 507-508 Bliss Building, Tulsa, Oklahoma.

Armstead, Daniel M.....May 21, 1912
Manager, Ingersoll-Rand Company, Saint Louis, Missouri.

Armstrong, Andrew A.....May 18, 1909
Assistant General Manager, Union Natural Gas Corporation, 1615 Union Bank Building, Pittsburgh, Pennsylvania.

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Armstrong, Thomas.....May 15, 1917
Inspector, Iroquois Natural Gas Company, 583 West Avenue, Buffalo, New York.

Arnold, W. H.....May 18, 1915
Representative, Pittsburgh Valve, Foundry & Construction Company, 1817 Tonapah Avenue, Pittsburgh, Pennsylvania.

Arras, Walter H.....May 16, 1916
Chief Clerk, Purchasing Department, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Ashley, Walter A.....May 16, 1916
Local Superintendent, Logan Natural Gas & Fuel Company, Chillicothe, Ohio.

Ashton, H. T.....May 18, 1915
Assistant Engineer, Ohio Cities Gas Company, 135 North Front Street, Columbus, Ohio.

Ayer, J. W.....May 19, 1914
Sales Manager, Reznor Manufacturing Company, Reznor Street, Mercer, Pennsylvania.

Baehr, William Alfred.....May 21, 1912
Consulting Engineer, 122 South Michigan Avenue, Chicago, Illinois.

Bagley, W. H.....May 18, 1915
Agent, Osage & Oklahoma Company, Pioneer Building, Tulsa, Oklahoma.

Bahan, J. P.....May 15, 1917
Clerk, The Texas Company, Natural Gas Department, 1708 Fairfield Avenue, Shreveport, Louisiana.

Baker, A. G.....May 16, 1916
Superintendent, Tri-County Natural Gas Company, Caledonia, New York.

Baker, C. M.....May 18, 1915
Chief Engineer, Petrolia Compressing Station, Lone Star Gas Company, Petrolia, Texas.

Baldwin, O. M.....May 15, 1917
Foreman, East Ohio Gas Company, 436 East Main Street, Kent, Ohio.

Ballard, Charles R.....May 18, 1909
Manufacturer, Ballard Patent Suction and Discharge Valves, Midway, Pennsylvania.

Ballard, H. O.....May 19, 1914
Superintendent of Production, Wichita Natural Gas Company, 605 East Third Street, Bartlesville, Oklahoma.

Barger, Louis F.....May 20, 1913
General Superintendent, Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Barnes, R. B.....May 16, 1911
District Superintendent, United Natural Gas Company, Mill Street, Brookville, Pennsylvania.

Barnsdall, T. N.....May 19, 1914
Manager and Treasurer, The Highland Gas Company, 24 West Corydon Street, Bradford, Pennsylvania.

Barr, James H.....May 18, 1915
President, The National Supply Company, Pittsburgh, Pennsylvania, and Toledo, Ohio.

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Barrett, M. F.....May 19, 1914
President, The Cleveland Brass Manufacturing Company, 4606-26 Hamilton Avenue, Cleveland, Ohio.

Barrett, William E.....May 21, 1912
Gas Engineer, J. G. White & Company, Inc., 43-49 Exchange Place, New York, New York.

Barrows, George S.....May 16, 1916
Manager Gas Heating Department, General Fire Extinguisher Company, 275 West Exchange Place, Providence, Rhode Island.

Barrows, L. E.....May 18, 1915
Engineer, The Texas Company Natural Gas Department, Fort Worth, Texas.

Barry, James.....May 16, 1916
Foreman, Arkansas Natural Gas Company, Prescott, Arkansas.

Bartlett, E. O.....May 16, 1911
Secretary-Treasurer, Texas Gas Company, 21 East Fortieth Street, New York, New York.

Bartlett, John C.....May 16, 1916
Secretary and Treasurer, Oklahoma Natural Gas Company, Caney River Gas Company, Enid Natural Gas Company. Assistant Secretary and Treasurer, Osage & Oklahoma Company, 1402 Union Bank Building, Pittsburgh, Pennsylvania.

Bartlett, R. H.....May 16, 1911
Assistant to the President, Oklahoma Natural Gas Company, 1402 Union Bank Building, Pittsburgh, Pennsylvania.

Bartley, E. L.....May 18, 1909
General Superintendent, American Natural Gas Company, 1511 Park Building, Pittsburgh, Pennsylvania.

Bartley, W. A.....May 16, 1916
District Superintendent, American Natural Gas Company, Indiana, Pennsylvania.

Bartow, A. T.....May 18, 1915
Distribution Engineer, Central Indiana Gas Company, Muncie, Indiana.

Bass, W. H.....May 15, 1917
Foreman, Alden-Batavia Natural Gas Company, Alden, New York.

Batchelor, G. F.....May 19, 1914
President, The Natural Gas Company of West Virginia, 323 Fourth Avenue, Pittsburgh, Pennsylvania.

Batdorf, E. D.....May 22, 1918
Cashier, The Dayton Gas Company, First and St. Clair, Dayton, Ohio.

Battin, Henry S.....May 21, 1912
Assistant General Superintendent, United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

Bauer, C. J.....May 18, 1915
Purchasing Agent, Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Bay, B. R.....May 15, 1917
Chief Engineer, The Medina Gas & Fuel Company, 139 Dickson Avenue, Mansfield, Ohio.

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Baxter, John.....May 21, 1912
Superintendent, Tube Department, Republic Iron & Steel Company, 248 Fairgreen Avenue, Youngstown, Ohio.

Baxter, W. C.....May 22, 1918
Superintendent, Wichita Pipe Line Company, First National Bank Building, Bartlesville, Oklahoma.

Beech, Ralph A.....May 16, 1916
Assistant to Superintendent, T. W. Phillips Gas & Oil Company, 120 East Cunningham Street, Butler, Pennsylvania.

Beardsley, R. D.....May 16, 1916
Treasurer, The Reserve Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Beatty, Elmer C.....May 16, 1916
Foreman, Manufacturers Gas Company, 65 West Corydon Street, Bradford, Pennsylvania.

Bedford, A. C.....May 16, 1916
President, The Peoples Natural Gas Company of Pittsburgh, Chairman of Board, Standard Oil Company, of New Jersey, 26 Broadway, New York, New York.

Bell, Charles D.....May 21, 1907
Assistant Superintendent, Southern California Gas Company, 1311 Albany Street, Los Angeles, California.

Benner, George K.....May 16, 1916
President, Benner Drilling Tool Company, 6431-6433 Penn Avenue, East End, Pittsburgh, Pennsylvania.

Benninger, N. H.....May 15, 1917
Superintendent, United Natural Gas Company, Station R, South Oil City, Pennsylvania.

Benninger, R. E.....May 15, 1917
Chief Engineer, United Natural Gas Company, Hallton, Pennsylvania.

Benson, L. B.....May 22, 1918
Assistant Superintendent Distribution, Empire Gas & Pipe Line Company, Bartlesville, Oklahoma.

Berg, C. O.....May 15, 1917
Foreman, United Natural Gas Company, Mabel Street, Reynoldsville, Pennsylvania.

Berwald, P. M.....May 18, 1915
General Manager, Pure Gasoline Company, 92 Main Street, Bradford, Pennsylvania.

Berry, B. N.....May 15, 1917
Contractor, Dominion Natural Gas Company, Caledonia, Ontario.

Bevan, R. L.....May 18, 1915
Second Assistant Treasurer, Calgary Gas Company, Limited, 215 Sixth Avenue, West, Calgary, Alberta, Canada.

Biddison, P. McDonald.....May 21, 1907
Construction Engineer, Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Bieler, O.....May 15, 1917
Salesman, Westinghouse Electric & Manufacturing Company, 1808 Union Bank Building, Pittsburgh, Pennsylvania.

Bigelow, Lucius S.....May 21, 1907
President-Editor, Periodicals Publishing Company, Littell Building, 68 West Huron Street, Buffalo, New York.

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Bigler, G. K......May 20, 1913
City Plant Foreman, United Natural Gas Company, Franklin, Pennsylvania.

Billingsley, J. E.....May 16, 1916
Assistant Geologist, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Bishop, H. W., Jr.....May 18, 1909
Representative, LaBelle Iron Works, Steubenville, Ohio

Blackall, T. P.....May 15, 1917
Regulator Inspector, Iroquois Natural Gas Company, 1398 Michgan Avenue, Buffalo, New York.

Blair, J. A.....May 22, 1918
Traveling Salesman, Waterbury Company, 63 Park Row, New York, New York.

Blake, B. F.....May 15, 1917
Chief Engineer, Treat Compressing Station, The Ohio Fuel Supply Company, Homer, Ohio.

Blauvelt, Warren S.....May 15, 1917
Consulting Engineer, Steere Engineering Company, Cor. Woodward and Horton Avenues, Detroit, Michigan.

Blewett, John T.....May 15, 1917
General Inspector, Iroquois Natural Gas Company, 75 Gold Street, Buffalo, New York.

Blum, William.....May 16, 1916
Superintendent, Sugar Grove Field, Logan Natural Gas & Fuel Company, Lancaster, Ohio.

Bodine, Samuel Taylor.....May 17, 1910
President, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

Boocks, C. W.....May 16, 1916
District Foreman, Hope Natural Gas Company, Hastings, West Virginia.

Booth, Arthur.....May 17, 1910
Vice President, Burson Supply Company, 242-244 First Avenue, Pittsburgh, Pennsylvania.

Booth, W. F.....May 20, 1913
Manager, Little Rock Gas & Fuel Company, 624 Louisiana Street, Little Rock, Arkansas.

Borchard, C. E.....May 15, 1917
Accountant, Dominion Natural Gas Company, Limited, 842 Marine National Bank Building, Buffalo, New York.

Bovaird, George W.....May 22, 1918
Bovaird & Company, Bradford, Pennsylvania.

Bower, J. B.....May 15, 1917
Manager, Central Pipe Line Company, Reymer, Ontario, Canada.

Boyd, G. S.....May 18, 1915
Chief Engineer, Mooringsport Refining Company, Mooringsport, Louisiana.

Boyd, Hugh T.....May 15, 1917
Chemist, The Ohio Fuel Supply Company, Homer, Ohio.

Boyle, E. R.....May 15, 1917
Manager, Oil City Derrick, 7 Center Street, Oil City, Pennsylvania.

Boyle, Patrick C.....May 20, 1913
President, The Derrick Publishing Company, 7 Centre Street, Oil City, Pennsylvania.

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Braden, Eugene.....May 16, 1916
Contractor, Ardizzone Braden Company, 507 Bliss Building, Tulsa, Oklahoma.

Braden, Glenn T.....May 17, 1910
President, Oklahoma Natural Gas Company, 214 Pioneer Building, Tulsa, Oklahoma.

Braden, H. W.....May 18, 1915
Superintendent, Dominion Natural Gas Company, Limited, 807 Bank of Hamilton, Hamilton, Ontario, Canada.

Bradford, Floyd J.....May 19, 1914
President and General Manager, Bradford Rig and Reel Company, 806 Daniels Building, Tulsa, Oklahoma.

Bradley, Harry.....May 20, 1913
President, Empire Gas & Fuel Company, Ltd., 78 North Main Street, Wellsville, New York.

Bradley, J. B.....May 18, 1915
Secretary and Treasurer, Hornell Gas Light Company, 96 Main Street, Hornell, New York.

Brady, M. A.....May 15, 1917
Foreman, Tri-County Natural Gas Company, Caledonia, New York.

Bragdon, Howard K.....May 15, 1917
Care of Guffey-Gillespie Company, 1203 Union Bank Building, Pittsburgh, Pennsylvania.

Brandel, S. F.....May 15, 1917
Foreman, Peoples Natural Gas Company, Gardenville, New York.

Braun, C. J., Jr.....May 16, 1911
Treasurer, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Brazier, John B.....May 18, 1915
Vice President and General Manager, Powhatan Brass & Iron Works, North Mildred Street and Belt Line Avenue, Ranson, Jefferson County, West Virginia.

Brenner, H. H.....May 21, 1912
President, Pawhuska Oil & Gas Company, Pawhuska, Oklahoma.

Brennan, H. W.....May 15, 1917
Foreman, The Texas Company, Moran, Texas.

Brewster, Henry.....May 16, 1916
Foreman, Hope Natural Gas Company, Weston, West Virginia.

Brinham, A. L.....May 15, 1917
Clerk, Union Natural Gas Corporation, 1929 Forbes Street, Pittsburgh, Pennsylvania.

Brink, George R.....May 18, 1909
Assistant Secretary-Treasurer, Union Natural Gas Corporation, Union Bank Building, Pittsburgh, Pennsylvania.

Brink, R. W.....May 16, 1916
General Auditor, Hope Natural Gas Company, 26 Broadway, New York, New York.

Brock, C. E.....May 22, 1918
Assistant Superintendent Gas Pipe Line, Empire Gas & Pipe Lines Company, Bartlesville, Oklahoma.

Broder, William J.....May 18, 1909
Vice President and General Manager, The Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

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Brooks, R. A.....May 15, 1917
Secretary-Treasurer, The Medina Gas & Fuel Company, Wooster, Ohio.

Brown, A. L.....May 22, 1918
Chemist, Preston Oil Company, 137 Sturgis Street, Mansfield, Ohio.

Brown, D. J.....May 18, 1909
Treasurer, Oil Well Supply Company, 213 Water Street, Pittsburgh, Pennsylvania.

Brown, E. R.....May 16, 1911
General Manager, Lone Star Gas Company, Corsicana, Texas.

Brown, Louis.....May 19, 1914
President, Oil Well Supply Company, 215 Water Street, Pittsburgh, Pennsylvania.

Brown, L. E. H.....May 15, 1917
Field Superintendent, Potter Gas Company, Roulette, Pennsylvania.

Brown, Leigh A.....May 15, 1917
Assistant Engineer, Iroquois Natural Gas Company, 102 18th Street, Buffalo, New York.

Brown, W. Re.....May 18, 1915
New Business Manager, The Ohio Fuel Supply Company, 97 North Street, Columbus, Ohio.

Bruce, W. W.....May 21, 1912
Superintendent, Oklahoma Fuel Supply Company, 419 East Eleventh Street, Chandler, Oklahoma.

Bruckner, O. L.....May 15, 1917
Agent, The Logan Natural Gas & Fuel Company, 12 East College Avenue, Westerville, Ohio.

Brunner, E.....May 15, 1917
Engineer, Hope Engineering & Supply Company, Mt. Vernon, Ohio.

Brundrett, Ernest L.....May 21, 1907
President, Kansas City Gas Company, 910 Grand Avenue, Kansas City, Missouri.

Bryant, C. L.....May 18, 1915
President, The Bryant Heater & Manufacturing Company, 952 East 72nd Street, Cleveland, Ohio.

Bub, L. G.....May 22, 1917
Chief Teller, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

Buchanan, James I.....May 16, 1916
President, Taylorstown Natural Gas Company, Terminal, Office Building, Pittsburgh, Pennsylvania.

Bullock, Charles L.....February 27, 1906
Superintendent Distribution, Empire Gas & Fuel Company, Bartlesville, Oklahoma.

Bullock, George.....May 15, 1917
Foreman, Southern Ontario Gas Company, Limited, Rodney, Ontario, Canada.

Burford, Ira S.....May 16, 1916
Agent, United Fuel Gas Company, Inc., 114 North Third Street, Ironton, Ohio.

Burkhalter, R. J.....May 20, 1913
Assistant Secretary and Treasurer, The Northwestern Ohio Natural Gas Company, 210-213 Huron Street, Toledo, Ohio.

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Burnett, Jerome B.....May 15, 1917
Professor of Geology, University of Oklahoma, 411 West Symmes Street, Norman, Oklahoma.

Burns, E. G.....May 18, 1915
Land Agent, Columbia Gas & Electric Company, 916 Tenth Street, Huntington, West Virginia.

Burns, T. P.....May 16, 1916
Shop Foreman, Hope Natural Gas Company, 1212 Juliana Street, Parkersburg, West Virginia.

Burnside, S. E. W.....May 16, 1916
Attorney, Hope Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Burr, R. B.....May 20, 1913
Industrial Engineer, The Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Burrell, George A.....May 20, 1913
Consulting Chemical Engineer, Benedum-Tress Building, Pittsburgh, Pennsylvania.

Burress, George H.....May 15, 1917
Geologist, Empire Gas & Fuel Company, Bartlesville, Oklahoma.

Burson, H. W.....May 16, 1918
President, Burson Supply Company, 242-244 First Avenue, Pittsburgh, Pennsylvania.

Burtner, James C.....May 16, 1916
Superintendent, Drilling Department, Medina Gas & Fuel Company, East Liberty Street, Wooster, Ohio.

Butler, C. L.....May 15, 1917
Accountant, Dominion Natural Gas Company, Limited, 842 Marine National Bank Building, Buffalo, New York.

Cabot, Godfrey L.....May 19, 1914
Proprietor, Plant at Cabot, Pennsylvania, 940 Old South Building, Boston, Massachusetts.

Cain, W. J.....May 15, 1917
Division Foreman, East Ohio Gas Company, Cuyahoga Falls, Ohio.

Callanan, J. T.....May 18, 1915
President and Treasurer, Parkersburg Machine Company, 603-605 Juliana Street, Parkersburg, West Virginia.

Campbell, J. P.....May 16, 1916
Foreman, Hope Natural Gas Company, Littleton, West Virginia.

Campbell, J. T.....May 16, 1916
Agent, The Manufacturers Light & Heat Company, 30 North Mill Street, New Castle, Pennsylvania.

Campbell, M. L.....May 16, 1916
Pittsburgh & Western Company, Salem, West Virginia.

Cantrell, C. C.....May 17, 1910
5 East Hobson Avenue, Sapulpa, Oklahoma.

Cappeau, J. P., Jr.....May 16, 1911
Benedum-Trees Building, Pittsburgh, Pennsylvania.

Carey, W. C.....May 15, 1917
Foreman Meter Repairs, Iroquois Natural Gas Company, 37 Ada Place, Buffalo, New York.

Carl, L. F.....May 15, 1917
Agent, The Newark Natural Gas & Fuel Company, 58 West Main Street, Newark, Ohio.

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Carmody, M. B.....May 18, 1909
Field Manager, Southwestern Gas & Electric Company, 1754 Irving Place, Shreveport, Louisiana.

Carpenter, Everett.....May 19, 1914
Chief Geologist, Continental Oil & Gas Company, Bartlesville, Oklahoma.

Carpenter, George R.....May 16, 1916
Superintendent, United Fuel Gas Company, 1207 Elmwood Avenue, Charleston, West Virginia.

Carson, W. B.....May 16, 1911
Secretary, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Carter, C. E.....May 18, 1915
President, Mansfield Gas Light Company, 8 South Park Street, Mansfield, Ohio.

Carter, Clarence E.....May 18, 1915
Salesman, The Ohio Fuel Supply Company, 97 North Front Street, Columbus, Ohio.

Carter, David J.....May 16, 1916
Attorney-at-Law, Carter & Sheets, 419-421 Goff Building, Clarksburg, West Virginia.

Carter, O. M.....May 16, 1916
President, United Gas Iron Company, 528 Peoples Gas Building, Chicago, Illinois.

Cartwright, T. R.....May 16, 1916
Superintendent, United Fuel Gas Company, Clendenin, West Virginia.

Cartwright, William Y.....May 21, 1912
Vice President, Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Case, L. L.....May 15, 1917
Local Agent, Ontario Gas Company, Holcomb, New York.

Cassel, Howard N.....May 20, 1913
Secretary-Treasurer and General Manager, Leflore County Gas & Electric Company, Poteau, Oklahoma.

Casto, A. T.....May 16, 1916
Superintendent, Randall Gas Company, 190 Chancery Row, Morgantown, West Virginia.

Cavenau, Charles.....May 16, 1916
Foreman, Reserve Gas Company, Wilsonburg, West Virginia.

Cavenagh, Frank.....May 17, 1910
Representative, Maryland Meter Works, of American Meter Company,, Baltimore, Maryland.

Chambers, Fred N.....May 15, 1917
Oil Producer, Chambers Oil Company, 214 Chambers Building, Oil City, Pennsylvania.

Chandler, L. F.....May 18, 1915
Superintendent, Santa Maria Gas & Power Company, 203 West Main Street, Santa Maria, California.

Chaplin, William C.....May 17, 1910
Treasurer, The Chaplin-Fulton Manufacturing Company, 34 Penn Avenue, Pittsburgh, Pennsylvania.

Chapman, W. B.....May 16, 1916
Oil Producer, 74 Vandergrift Building, Pittsburgh, Pennsylvania.

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Chase, Frank L.....May 22, 1918
Manager Gas Department, Lone Star Gas Company, Fort Worth, Texas.

Clagett, E. F.....May 18, 1915
Engineer, The Columbus Gas & Fuel Company, 135 North Front Street, Columbus, Ohio.

Clark, C. L.....May 15, 1917
Foreman, Iroquois Natural Gas Company, 95 Mechanic Street, Bradford, Pennsylvania.

Clark, Earl A.....May 16, 1911
Proportional and Domestic Service, Meter Testing, 217 A. W. 5th, Tulsa, Oklahoma.

Clark, James.....May 19, 1914
Division Superintendent, Philadelphia Company, 17th and Wharton Streets, Pittsburgh, Pennsylvania.

Clark, J. S.....May 19, 1914
Manager, Okmulgee Gas Company, 319 West Sixth Street, Okmulgee, Oklahoma.

Clark, Robert E.....May 16, 1916
Assistant Land Agent, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Clark, Walton.....May 21, 1907
Second Vice-President, United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

Clarkson, R. J.....May 19, 1914
Division Superintendent, Philadelphia of West Virginia, Littleton, West Virginia.

Clawson, W. B.....May 15, 1917
Superintendent, Warren & Chant Gas Company, 309 Popular Street, Warren, Pennsylvania.

Cleary, J. D.....May 15, 1917
Agent, Angola, New York, Iroquois Natural Gas Company, Angola, New York.

Clifford, Thomas C.....May 16, 1911
Sales Manager, Pittsburgh Meter Company, East Pittsburgh, Pennsylvania.

Cline, Walter B.....May 21, 1912
President, Los Angeles Gas & Electric Corporation, 645 South Hill Street, Los Angeles, California.

Clover, John M.....May 15, 1917
President, The Iron Mountain Oil Company, P. O. Box 811, Tulsa, Oklahoma.

Clover, M. K.....May 18, 1915
Manager, Berea Pipe Line Company, 9 Front Street, Berea, Ohio.

Clover, S. C.....May 15, 1917
Oil & Gas Department, The Iron Mountain Oil Company, 409 Unity Building, Tulsa, Oklahoma.

Cluley, C. F.....May 20, 1913
Agent, The East Ohio Gas Company, Millersburg, Ohio.

Cochran, Horace J.....May 18, 1915
President and Manager, Maysville Gas Company, Maysville, Kentucky.

Cohn, Charles M.....May 21, 1912
Vice President, Cons. Gas, Electric Light & Power Company of Baltimore, 100 West Lexington Street, Baltimore, Maryland.

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Cole, E. J......May 16, 1911
Purchasing Agent and Auditor, Arkansas Natural Gas Company, State Bank Building, Little Rock, Arkansas.

Cole, W. G......May 16, 1911
Division Superintendent, Equitable Gas Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Coleman, L. G......May 19, 1914
Engineer, Henry L. Doherty & Company, 60 Wall Street, New York, New York.

Collins, Frank.....May 18, 1915
Vice President, National Supply Company, President, Toledo Pipe Threading Machine Company, Toledo, Ohio.

Connelly, J. S......June 12, 1906
President, Port Arthur Gas & Power Company, Port Arthur, Texas.

Connors, Eugene F......May 15, 1917
General Superintendent, Pittsburgh Oil & Gas Company, Farmers Bank Building, Pittsburgh, Pennsylvania.

Connors, Joseph P......May 15, 1917
Cashier, Iroquois Natural Gas Company, 45 Church Street, Buffalo, New York.

Cookham, P. J......May 15, 1917
Superintendent, Berea Pipe Line Company, 88 Furnace Street, Berea, Ohio.

Cooper, H. C......May 20, 1913
Chief Engineer, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Corbett, M. A......May 17, 1910
Secretary, Corbett-Stevens Company, Huntington Bank Building, Columbus, Ohio.

Corbus, C. D......May 20, 1913
Manager, Welsbach Company, 429 Main Street, Cincinnati, Ohio.

Corcoran, W. F......May 21, 1907
Contractor, James C. Corcoran Company, 415 House Building, Pittsburgh, Pennsylvania.

Corrin, John B......May 20, 1913
Vice President and General Manager, The Reserve Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Cosan, Frank.....May 15, 1917
Land Department Clerk, Dominion Natural Gas Company, 842 Marine Bank Building, Buffalo, New York.

Coste, Dillon.....May 20, 1913
Secretary, Calgary Gas Company, Limited, 215 Sixth Avenue, Calgary, Alberta, Canada.

Coste, D. A......May 15, 1917
Treasurer, Provincial Natural Gas & Fuel Company, Drawer 55, Niagara Falls, Ontario, Canada.

Coste, Eugene.....May 20, 1913
President, The Canadian Western Natural Gas, Light, Heat & Power Company, Ltd., 128 Seventh Avenue, East, Calgary, Alberta, Canada.

Couch, H. V......May 22, 1918
Purchasing Agent, United Natural Gas Company, 308 Seneca Street, Oil City, Pennsylvania.

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Covey, A. F.....May 18, 1915
Superintendent, Dominion Natural Gas Company, 807 Bank of Hamilton Building, Hamilton, Ontario, Canada.

Courtney, D. H.....May 18, 1915
President, Randall Gas Company, 179 High, Morgantown, West Virginia.

Cowham, H. I.....May 21, 1912
Manager Land Department, Kasigan Oil, Gas & Power Company, 115½ East Main Street, Independence, Kansas.

Cox, Frank.....May 18, 1915
Secretary, Navajo Gas Company, Charleston, West Virginia.

Coyle, Henry.....May 18, 1909
Superintendent, Mains and Field, Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Craft, Charles.....May 16, 1911
Chief Engineer, East Ohio Gas Company, East Ohio Gas Company, West Park, Ohio.

Crahan, B. J.....May 17, 1910
Manager, Port Huron Gas & Electric Company, Port Huron, Michigan.

Craig, Albert B.....May 16, 1916
Geologist Greensboro Gas Company, 248 Fourth Avenue, Pittsburgh, Pennsylvania.

Craig, W. P.....May 20, 1913
General Superintendent, United Natural Gas Company, 308 Seneca Street, Oil City, Pennsylvania.

Cratty, James M.....May 15, 1917
Foreman, Meter Department, Pennsylvania Gas Company, Jamestown, New York.

Crawford, A. A.....May 16, 1916
General Superintendent, Manufacturers Gas Company, 23 Chautauqua Place, Bradford, Pennsylvania.

Crawford, C. J.....May 16, 1916
1028 Liberty Street, Franklin, Pennsylvania.

Crawford, David B.....May 16, 1911
Secretary and Treasurer, Parkersburg Rig and Reel Company, 626 Marietta Avenue, Parkersburg, West Virginia.

Crawford, F. H.....May 16, 1911
Chief Engineer, The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Crawford, Frederick W.....May 18, 1909
President, United Fuel Gas Company, 52 West Gay Street, Columbus, Ohio.

Crawford, George W.....May 17, 1910
President, Ohio Fuel Supply Company, 2017 Farmers Bank Building, Pittsburgh, Pennsylvania.

Crawford, James B.....May 16, 1911
United Natural Gas Company, 308 Seneca Street, Oil City, Pennsylvania.

Crawford, John M.....May 16, 1911
President, Parkersburg Rig and Reel Company, Box 716, Parkersburg, West Virginia.

Crawford, J. W. R.....May 16, 1911
61 Broadway, New York, New York.

Crawford, R. A.....May 20, 1913
167 South Fountain Avenue, Wichita, Kansas.

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Creveling, J. D.....May 15, 1917
Consulting Engineer, Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Critchfield, C. F.....May 16, 1916
Special Agent, The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Cronin, John M.....May 18, 1915
Assistant Manager, Columbia Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Crosby, G. A.....May 16, 1916
Surveyor, Land Department, Potter Gas Company, 1011 Farmers Bank Building, Pittsburgh, Pennsylvania.

Cross, F. A.....May 20, 1913
Chief Station Engineer, United Natural Gas Company, Ten-Mile Bottom, Pennsylvania.

Cross, Raymond.....May 16, 1911
President, United Natural Gas Company, 203 Seneca Street, Oil City, Pennsylvania.

Crossett, John.....May 16, 1911
Division Superintendent, Philadelphia Company, Arch Street, Kittanning, Pennsylvania.

Crowl, P. E.....May 15, 1917
Agent, Potter Gas Company, Galeton, Pennsylvania.

Crum, M. C.....May 16, 1916
Agent, The Peoples Natural Gas Company, Monessen, Pennsylvania.

Cullinan, M. P.....May 20, 1913
President and Manager, Border Gas Company, 619 Salinas Avenue, Laredo, Texas.

Culp, Harry C.....May 15, 1917
Salesman, Ingersoll-Rand Company, Williamson Building, Cleveland, Ohio.

Cummings, C. E.....May 19, 1914
President and General Manager, East Brady Gas Fuel Company, East Brady, Pennsylvania.

Cummings, Con.....May 21, 1912
Contractor, 115 North Fourth Street, Independence, Kansas.

Cummings, E. A.....May 15, 1917
Assistant Treasurer, Moncton Tramways, Electricity & Gas Company, Limited, Moncton, New Brunswick, Canada.

Cummings, W. G.....May 22, 1918
Proprietor, Wm. G. Cummings, 803 Union Bank Building, Pittsburgh, Pennsylvania.

Cunningham, R. H.....May 16, 1916
Sales Engineer, Ingersoll-Rand Company, 1226 Farmers Bank Building, Pittsburgh, Pennsylvania.

Curry, J. F.....May 16, 1911
Superintendent of Distribution, The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Curry, J. P.....May 20, 1913
Agent, United Natural Gas Company, 15 Vine Street, Sharon, Pennsylvania.

Curtis, Austin G.....May 19, 1908
General Manager, Southwestern Gas & Electric Company, 116 Texas Street, Shreveport, Louisiana.

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Cusack, W. M.....May 20, 1913
Treasurer, Iroquois Natural Gas Company, 45 Church Street, Buffalo, New York.

Cushing, J. W.....May 15, 1917
Oil and Gas Producer, Sistersville, West Virginia.

Cushing, Robert W.....May 19, 1914
Field Superintendent, Natural Gas Company of West Virginia, Leetonia, Columbiana County, Ohio.

Custer, Z. B.....May 19, 1908
Vice President, Custer Coupling Company, 39 Foreman Street, Bradford, Pennsylvania.

Cypher, M. B.....May 16, 1916
Contractor and Producer, Marwood, Pennsylvania.

Dallow, J. C.....May 18, 1909
Representative, The National Supply Company, Lancaster, Ohio.

Daily, A. B., Jr.....May 18, 1909
President and Manager, South Hills Oil & Gas Company, 223 Fourth Avenue, Pittsburgh, Pennsylvania.

Daily, C. A., Jr.....May 20, 1913
Manager, Reserve Natural Gas Company of Louisiana. P. O. Box 191, Shreveport, Louisiana.

Daly, Martin B.....May 18, 1909
President and General Manager, The East Ohio Gas Company, East Ohio Gas Building, 1405 East Sixth Street, Cleveland, Ohio.

Daugherty, O. J.....May 18, 1915
Superintendent, LaBelle Gas & Oil Company, 220 West Street, Steubenville, Ohio.

Dauler, Harvey N.....May 15, 1917
President, Petroleum Products Company, 39th Street and B. & O. Railway, Pittsburgh, Pennsylvania.

Davies, O. L.....May 18, 1915
Agent, United Fuel Gas Company, 814 Fourth Avenue, Huntington, West Virginia.

Davies, Stuart W.....May 16, 1916
Cashier, The Calgary Gas Company, Limited, 215-16 Sixth Avenue, West, Calgary, Alberta, Canada.

Davies, William B.....May 16, 1916
Engineer, Empire Oil & Gas Company, Inc., 332 South Main Street, Winchester, Kentucky.

Davis, A. P.....May 20, 1913
Commercial Manager, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Davis, Herbert R.....May 21, 1907
General Superintendent, Dominion Natural Gas Company, Ltd., 842 Marine National Bank Building, Buffalo, New York.

Dawes, Beman G.....May 17, 1910
President, Columbus Gas & Fuel Company, 135 North Front Street, Columbus, Ohio.

Dawes, Henry M.....May 17, 1910
President, Pulaski Gas Light Company (Little Rock, Ark.), 1615 Harris Trust Building, Chicago, Illinois.

Deal, E. O.....May 15, 1917
Chief Clerk, The East Ohio Gas Company, 714 High Street, S. W., Canton, Ohio.

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Deemer, F. C......May 18, 1909
Gas and Oil Operator, 200 Jefferson Street, Brookville, Pennsylvania.

DeForest, C. W......May 15, 1917
Electrical Engineer, Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Delaney, Joseph P......May 20, 1913
City Superintendent, The Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Denning, Leslie B......May 16, 1911
President, Lone Star Gas Company, 2017 Farmers Bank Building, Pittsburgh, Pennsylvania.

Denton, Dorr T......May 15, 1917
Division Superintendent, Iroquois Natural Gas Company, 46 Clarendon, Buffalo, New York.

Devericks, Filmore C......May 16, 1916
Independent Producer, 251 Buena Vista Avenue, Clarksburg, West Virginia.

DeWeese, Charles......May 22, 1918
Assistant Superintendent Gas Distribution and Const., Louisville Gas & Electric Company, 311 West Chestnut, Louisville, Kentucky.

DeWitt, D. C......May 15, 1917
Lease Department, Southern Gas Company, Box 767 Corpus Christi, Texas.

Dibbens, W. J......May 19, 1908
Vice President and General Manager, Guthrie Gas Light, Fuel & Improvement Company, 213 East Oklahoma Avenue, Guthrie, Oklahoma.

Diescher, Alfred J......May 18, 1909
Vice President and General Manager, Wichita Natural Gas Company, 60 Wall Street, New York, New York.

Dimick, W. H......May 20, 1913
Agent, The East Ohio Gas Company, 202 West High Street, New Philadelphia, Ohio.

Dingman, L. R......May 16, 1916
District Foreman, Equitable Gas Company, 635 Corey Avenue, Braddock, Pennsylvania.

Dittman, C. E......May 17, 1910
Manager, Waynesburg Home Gas Company, Waynesburg, Pennsylvania.

Dittman, D. M......May 15, 1917
Foreman, Iroquois Natural Gas Company, Hamburg, New York.

Ditto, William A......May 16, 1916
Superintendent, Bradford Gas Company, Roulette, Pennsylvania.

Dixon, Philip......May 18, 1909
Superintendent, St. Marys Gas Company, St. Marys, Pennsylvania.

Dodds, Caryl J......June 12, 1906
General Manager, Citizens Light, Heat & Power Company, 5 East Henry Street, Lawrence, Kansas.

Doebele, W. J......May 22, 1918
Agent, Ohio Fuel Supply Company, Miamisburg, Ohio.

Doherty, Henry L......February 27, 1906
President, Cities Service Company, 60 Wall Street, New York, New York.

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Dolen, R. F.....May 16, 1916
Foreman, Pittsburgh & West Virginia Gas Company, 965 West Pike Street, Clarksburg, West Virginia.

Dooling, F. T.....May 15, 1917
Machinist, East Ohio Gas Company, 10601 Hathaway Avenue, Cleveland, Ohio.

Donahue, T. C.....May 15, 1917
Pressure Department, East Ohio Gas Company, 9301 Columbia Avenue, Cleveland, Ohio.

Donaldson, F. N.....May 16, 1911
Owner, Donaldson Gas Company, Jewett, Ohio.

Donehue, D. M.....May 22, 1918
Producer, Titusville, Pennsylvania.

Donnelly, William E.....May 16, 1916
General Superintendent, Northeastern Oil & Gas Company, 17 North Broadway, Geneva, Ohio.

Donovan, B. H.....May 20, 1913
Foreman, Pennsylvania Gas Company, Warren, Pennsylvania.

Dougherty, F. D.....May 16, 1916
Superintendent Gas Wells, William Harris Company, Wooster, Wayne County, Ohio.

Douglass, Silas M.....May 18, 1909
General Counsel, Logan Natural Gas & Fuel Company, 22½ South Park Street, Mansfield, Ohio.

Douthirt, W. F.....May 21, 1907
Fourth Vice President, United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

Dowd, Bernard F.....May 15, 1917
Manager, Peoples Natural Gas Company, 39 Argyle Park, Buffalo, New York.

Downing, C. W.....May 20, 1913
Assistant Secretary and Treasurer, East Ohio Gas Company, East Sixth Street, Cleveland, Ohio.

Doyle, Frederick F.....May 19, 1914
Assistant Chief Engineer, Midway Gas Company, Box N, Taft, California.

Dreibelbis, H. H.....May 21, 1912
Division Superintendent, The Ohio Fuel Supply Company, 59 North Fourth Street, Zanesville, Ohio.

Dresser, Carl K.....May 15, 1917
President, Malta & McConnelsville (Ohio) Gas Company, 54 Boyleston Street, Bradford, Pennsylvania.

Droppleman, W. J.....May 16, 1916
Foreman, Hope Natural Gas Company, McWhorter, West Virginia.

Drury, George F.....May 15, 1917
Oil Producer, J. W. Leonard Oil Company, North Main Street, Washington, Pennsylvania.

Duffield, C. S.....May 16, 1916
Purchasing Agent, United Fuel Gas Company, Quarrier Street, Charleston, West Virginia. In service.

Duffield, James C.....May 20, 1913
Managing Director, London City Gas Company, London, Ontario, Canada.

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Duncan, John.....May 16, 1911
General Manager of Sales, Wheeling Steel & Iron Company, Wheeling, West Virginia.

Dunham, Carl Cyrus.....May 16, 1916
Meter Department, Pittsburgh & West Virginia Gas Company, 3 Center Avenue, Weston, West Virginia.

Dunn, T. A.....May 15, 1917
Field Superintendent, Potter Gas Company, Port Allegheny, Pennsylvania.

Dusenberry, D. F.....May 16, 1916
Gas Engineer, West Virginia Traction & Electric and City & Suburban Gas Company, 298 Wiles Street, Morgantown, West Virginia.

Eastland, S. H.....May 16, 1916
District Foreman, Philadelphia Company, 2308 Main Street, Sharpsburg, Pennsylvania.

Edwards, William C.....May 16, 1916
Vice President, Parker & Edwards Oil Company, Union Bank Building, Pittsburgh, Pennsylvania.

Egan, E. J.....May 16, 1916
Agent, The Manufacturers Light & Heat Company, Millbridge and Manton Streets, Pittsburgh, Pennsylvania.

Emmerling, Karl.....May 18, 1915
Chemist, The East Ohio Gas Company, 3105 Walton Avenue, Cleveland, Ohio.

Engle, T. W.....May 19, 1914
Division Superintendent, Pittsburgh & West Virginia Gas Company, 537 West Main Street, Grafton, West Virginia.

Ernst, H. M.....May 18, 1915
President, Dempseytown Gas Company, Treet Company Building, Oil City, Pennsylvania.

Espach, Frank.....May 18, 1915
Chief Inspector, Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Evans, C. D.....May 16, 1911
Division Superintendent, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Evans, George M.....May 22, 1918
Contractor, P. N. G. & Philadelphia Company, 156 McCargo Street, New Kensington, Pennsylvania.

Evans, J. J.....May 18, 1915
Superintendent, Hope Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Evans, Todd.....May 22, 1918
Treasurer and Manager, Barnsdall Printing Company, 14 Chambers Street, Bradford, Pennsylvania.

Ewing, A. M.....May 15, 1917
Meter Department, Central Station Gas Company, 214 South Fifth, Vincennes, Indiana.

Ewing, Fenwick.....May 15, 1917
Leasing Superintendent, Medina Gas & Fuel Company, The Columbus Natural Gas Company, Wooster, Ohio.

Ewing, J. J.....May 16, 1916
House Piper, Own Business, 952 Fifth Avenue, Coraopolis, Pennsylvania.

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Fair, F.....May 18, 1915
South Shore Natural Gas & Fuel Company, 307 Central Avenue, Dunkirk, New York.

Fairchild, F. A.....May 15, 1917
Agent, United Natural Gas Company, 901 Water Street, Meadville, Pennsylvania.

Falk, F. I.....May 18, 1915
Assistant Treasurer, The Ohio Fuel Supply Company, 2017 Farmers Bank Building, Pittsburgh, Pennsylvania.

Falk, G. E.....May 15, 1917
Cashier, South Shore Natural Gas & Fuel Company, 307 Central Avenue, Dunkirk, New York.

Farner, J. W.....May 16, 1916
Superintendent, Potter Gas Company, Port Allegheny, Pennsylvania.

Fay, Peter.....May 15, 1917
Field Superintendent, Potter Gas Company, R. F. D. No. 2, Smethport, Pennsylvania.

Felix, Otto F.....May 21, 1912
Secretary and Treasurer, Equitable Meter Company, 422 First Avenue, Pittsburgh, Pennsylvania.

Fessler, T. A.....May 15, 1917
Agent, Potter Gas Company, Elkland, Pennsylvania.

Field, Roy A.....
American Railways Company, Witherspoon Building, Philadelphia, Pa.

Finley, H. F.....May 16, 1916
Agent, The Logan Natural Gas & Fuel Company, 28 South Park Street, Mansfield, Ohio.

Finney, Frank F.....May 17, 1910
Superintendent Gas Department, Indian Territory Illuminating Oil Company, Bartlesville, Oklahoma.

Fish, Harry P.....May 20, 1913
General Foreman, The East Ohio Gas Company, 207 Regent Street, Youngstown, Ohio.

Fisher, Francis P.....May 21, 1907
General Manager, Wichita Natural Gas Company, First National Bank Building, Bartlesville, Oklahoma.

Fisher, H. H.....May 22, 1918
Proprietor, H. H. Fisher Company, 336 Fourth Avenue, Pittsburgh, Pennsylvania.

Fisher, James P.....May 22, 1918
Chief Technologist, Wichita Natural Gas Company, First National Bank Building, Bartlesville, Oklahoma.

Fisler, J. H.....May 15, 1917
Clarence, New York.

Fitzgibbon, A. J.....May 22, 1918
Salesman, A. M. Byers Company, Union Bank Building, Pittsburgh, Pennsylvania.

Flanigan, J. T.....May 15, 1917
Foreman, Iroquois Natural Gas Company, 20 Weyand Street, Buffalo, New York. In service.

Fleming, Arthur C.....May 18, 1915
Superintendent, Pennsylvania Fuel Supply Company, Broad Street, New Bethlehem, Pennsylvania.

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Fleming, Claude M.....May 16, 1916
Foreman, Hope Natural Gas Company, 202 Locust Street, Mannington, West Virginia.

Fleming, Curtis B.....May 16, 1916
Producer Oil and Gas, P. O. Box 193, Fairmont, West Virginia.

Fleming, George F.....May 15, 1917
Agent, United Natural Gas Company, 120 West Spence Street, Titusville, Pennsylvania.

Flinn, T. W. H.....May 16, 1916
Appliances, Flinn Appliance House, 607 West Main Street, Denison, Texas.

Flint, R. B.....May 15, 1917
Meter Inspector, Potter Gas Company, Port Allegheny, Pennsylvania.

Flocken, Alfred F.....May 16, 1916
Bookkeeper, Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Foley, John.....May 18, 1915
General Field Superintendent, The Manufacturers Light & Heat Company, 119 Greenside Avenue, Canonsburg, Pennsylvania.

Foley, T. B.....May 16, 1916
Contractor, T. B. Foley, 410 Diamond Bank Building, Pittsburgh, Pennsylvania.

Foley, T. H.....May 16, 1916
Superintendent, T. B. Foley, Contractor, 410 Diamond Bank Building, Pittsburgh, Pennsylvania.

Fonner, J. H.....May 16, 1916
Shop Foreman and Agent, The Peoples Natural Gas Company, 616 Midland Avenue, Midland, Pennsylvania.

Forman, H. A.....May 16, 1911
Vice President, Eastern Oil Company, 312 Fidelity Building, Buffalo, New York.

Forstall, Alfred E.....May 21, 1912
Consulting Engineer, Forstall and Robison, 15 Park Row, New York, New York.

Foster, H. V.....May 21, 1912
President, Indian Territory Illuminating Oil and Gas Company, 111 East Eighth Street, Bartlesville, Oklahoma.

Foster, J. E.....May 20, 1913
Agent, The East Ohio Gas Company, 107 North Erie Street, Massilon, Ohio.

Fox, E. C.....May 18, 1915
Manager, The Gas Appliance Company, 713 Frankfort Avenue, Cleveland, Ohio.

Frainer, J. E.....May 18, 1915
Sun Gas Company, Salem, West Virginia.

Fralic, F. A.....May 15, 1917
Agent and Superintendent, Logan Natural Gas & Fuel Company, 139 West Main Street, Galion, Ohio.

Frantz, I. D.....May 16, 1916
Division Superintendent, Hope Natural Gas Company, 119 Daisy Street, Clarksburg, West Virginia.

Franz, W. E.....May 18, 1915
Street Foreman, Natural Gas Department, The Dayton Gas Company, 218 South Jefferson Street, Dayton, Ohio.

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Frazier, J. E.....May 18, 1915
Superintendent, Charleston-Dunbar Natural Gas Company, 404 Ruffner Avenue, Charleston, West Virginia.

Freeland, F. D.....May 22, 1918
Well Gauger, Peoples Natural Gas Company, Brave, Greene County, Pennsylvania.

Freeman, W. W.....May 18, 1915
President, Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Frees, W. H.....May 16, 1916
Rig Builder, 661 Buckeye Street, Wooster, Ohio.

French, F. A.....May 15, 1917
Agent, Potter Gas Company, Coudersport, Pennsylvania.

Freudenberger, William.....
President Freudenberger Oil Company, 504 Charleston National Bank Building, Charleston, West Virginia.

Frevert, Robert A.....May 15, 1917
Industrial Engineer, Dayton Gas Company, Dayton, Ohio.

Frey, W. S.....May 15, 1917
Agent, Logan Natural Gas & Fuel Company, 209 South Sandusky Street, Bucyrus, Ohio.

Friedenberg, D.....May 18, 1909
Auditor, Union Natural Gas Corporation, Union Bank Building, Pittsburgh, Pennsylvania.

Frohrieb, L. C.....May 16, 1911
Secretary, Federal Engineering Company, 1116 House Building, Pittsburgh, Pennsylvania.

Fuller, E. K.....May 15, 1917
Agent, East Aurora, New York, Iroquois Natural Gas Company, East Aurora, New York.

Fulson, H.....May 15, 1917
Foreman, Woodstock Gas Company, 18 Railway Street, Woodstock, Ontario, Canada.

Funk, F. O.....May 19, 1914
Oil and Gas Operators, Cochran & Funk, Eighth Street, Moundsville, West Virginia.

Funk, W. T.....May 18, 1915
Auditor, Oil and Gas Companies, Commercial Bank Building, Titusville, Pennsylvania.

Fye, J. L.....May 16, 1911
Division Superintendent, Philadelphia Company, 242 Morgan Street, Waynesburg, Pennsylvania.

Gage, W. P.....May 17, 1910
First Vice President and General Manager, Lone Star Gas Company, P. O. Box 1022, Fort Worth, Texas.

Gager, H. A.....May 18, 1915
Clerk, The Natural Gas Company of West Virginia, 34 Garfield Avenue, Salem, Ohio.

Gale, Glen N.....May 15, 1917
Superintendent Glenwood Station Southern Ontario Gas Company, Limited, R. R. No. 4, Merlin, Ontario, Canada.

Gallagher, C. E.....May 20, 1913
Agent, The East Ohio Gas Company, Youngstown, Ohio.

Gallagher, R. W.....May 21, 1912
Assistant General Manager, The East Ohio Gas Company, East Ohio Gas Building, Cleveland, Ohio.

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Garard, Charles H.....May 19, 1914
Superintendent, Southern Ohio Division, The Ohio Fuel Supply Company, 124 North Pennsylvania Avenue, Wellston, Ohio.

Garard, F. L.....May 16, 1916
Assistant Superintendent and Agent, Fayette County Gas Company, 403 First National Bank Building, Uniontown, Pennsylvania.

Garard, John M.....May 18, 1909
Vice President and General Manager, The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Gardner, C. W.....May 16, 1916
Engineering Department, The East Ohio Gas Company, East Ohio Gas Building, Cleveland, Ohio.

Garner, J. B.....May 16, 1916
Chemical Engineer, Hope Natural Gas Company, 5624 Woodmont Street, Pittsburgh, Pennsylvania.

Garrity, M. J.....May 16, 1916
District Foreman, Equitable Gas Company, 9th Street, McKeesport, Pennsylvania.

Gassdorf, G. I.....May 16, 1916
Superintendent of Construction, The Huntington Development & Gas Company, 928 Third Avenue, Huntington, West Virginia.

Gassett, A. L.....May 19, 1908
President, Economy Stove Company, 2108 Superior Viaduct, Cleveland, Ohio.

Gates, C. B.....May 20, 1913
Chief Clerk, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

Gates, John, Jr.....May 16, 1911
Attorney, Land Department, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Gavin, A. W.....May 15, 1917
Assistant City Superintendent, Iroquois Natural Gas Company, 486 Linwood Avenue, Buffalo, New York.

Geary, D. J.....May 16, 1911
Sales Manager, Republic Iron & Steel Company, Republic Building, Youngstown, Ohio.

Geist, J. E.....May 15, 1917
Assistant Superintendent, United Fuel Gas Company, Spencer, West Virginia.

Geist, J. F.....May 16, 1916
Superintendent, United Fuel Gas Company, Ravenswood Pike, Spencer, West Virginia.

Germer, E. G.....May 20, 1913
President, Germer Stove Company, 16th and Parade Streets, Erie, Pennsylvania.

Gericke, Oscar C.....May 15, 1917
Orifice Meter Department, The East Ohio Gas Company, 9501 Willard Avenue, Cleveland, Ohio.

Gessel, B. M.....May 15, 1917
President, Anchor Oil Company, 1108 South Cheyenne, Tulsa, Oklahoma.

Gibson, C. A.....May 19, 1908
Kansas Natural Gas Company, P. O. Drawer 465, Independence, Kansas.

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Giegel, F. G......May 20, 1913
General Foreman, The Northwestern Ohio Natural Gas Company, 210-212 Huron Street, Toledo, Ohio.

Gifford, B. J......May 21, 1912
Superintendent, Little Rock Gas & Fuel Company, 624 Louisiana Street, Little Rock, Arkansas.

Gilbert, A. J......May 16, 1916
Foreman, Arkansas Natural Gas Company, Malvern, Arkansas.

Gill, John E......May 16, 1911
President, Manufacturers Light & Heat Company, 310 Columbia Bank Building, Pittsburgh, Pennsylvania.

Gill, S. M......May 22, 1918
Assistant Credit Clerk, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

Gindele, Albert H......May 18, 1915
Industrial Gas Engineer, Toledo Railway & Light Company, 1120 Norwood Avenue, Toledo, Ohio.

Given, E......May 18, 1915
Field Superintendent, The East Ohio Gas Company, 6110 Franklin Avenue, Cleveland, Ohio.

Glasgow, Arthur Graham.....May 21, 1912
Chairman, Humphreys & Glasgow, Ltd., 36 and 38 Victoria Street, London, S. W., England.

Glass, John.....May 16, 1911
Chief Engineer, Carnegie Natural Gas Company, 245 North Bridge Street, Waynesburg, Pennsylvania.

Glass, Roy.....May 16, 1916
Construction Engineer, Carnegie Natural Gas Company, Box 45, Hastings, West Virginia.

Gleason, C. W......May 20, 1913
Division Engineer, United Natural Gas Company, 507 North Street, Oil City, Pennsylvania.

Goble, Benjamin F......May 15, 1917
Foreman, United Natural Gas Company, Shinglehouse, Potter County, Pennsylvania.

Goff, George S......May 17, 1910
General Manager, Crystal Gas Company, 26 East Market Street, Corning, New York.

Goldsborough, J. R......May 19, 1914
Titusville Supply Company, 1520 Farmers Bank Building, Pittsburgh, Pennsylvania.

Goodrich, H. B......May 17, 1910
Consulting Geologist, Ardmore, Oklahoma.

Grace, Clarence H......May 16, 1916
Manager, Gas Journal Publishers, Ltd., Hamilton, Ontario, Canada.

Graffis, Wm. H......May 20, 1913
Publisher (President), Gas Publishing Company (The Gas Record), 20 West Jackson Boulevard, Chicago, Illinois.

Graham, Lyman L......May 20, 1913
Secretary, United Natural Gas Company, 206 Seneca Street, Oil City, Pennsylvania.

Grant, C. E......May 18, 1915
Agent, Pennsylvania Fuel Supply Company, 416 Main Street, Emlenton, Pennsylvania.

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Gray, A. R.....May 16, 1916
Assistant General Superintendent, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Gray, Homer R.....May 20, 1913
Assistant Treasurer, Iroquois Natural Gas Company, Iroquois Building, Buffalo, New York.

Gray, J. F.....May 20, 1913
Chief Engineer, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

Grear, W. S.....May 19, 1908
District Superintendent, Welsbach Street Lighting Company of America, 122 South Michigan Avenue, Chicago, Illinois.

Greenawalt, E. J.....May 18, 1915
Trunk Line Foreman, Columbia Gas & Electric Company, 1206 Jefferson Avenue, Huntington, West Virginia.

Greis, Harry N.....May 21, 1912
President, Atlantic Petroleum Corporation, Tulsa, Oklahoma.

Gribble, Wallace B.....May 15, 1917
Special Representative, Hope Natural Gas Company, Gore Hotel, Clarksburg, West Virginia.

Griswold, Robert G.....May 18, 1915
Chief Technologist, Henry L. Doherty & Company, 60 Wall Street, New York, New York.

Griswold, William T.....May 16, 1911
Geologist, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Grobel, J. C.....May 16, 1916
Vice President and Assistant Manager, Reynolds Gas Regulator, Anderson, Indiana.

Grosscup, Fred Paul.....May 18, 1915
President, Charleston-Dunbar Natural Gas Company, Charleston, West Virginia.

Grosscup, Paul B.....May 18, 1915
Vice President and General Manager, Charleston-Dunbar Natural Gas Company, Charleston, West Virginia.

Grunder, F. D.....May 15, 1917
Assistant General Sales Manager, Tube Department, Jones & Laughlin Steel Company, 412 Jones and Laughlin Building, Pittsburgh, Pennsylvania.

Guffey, Joseph F.....May 16, 1911
Guffey-Gillespie Company, 1203 Union Bank Building, Pittsburgh, Pennsylvania.

Gurnsey, W. M.....May 18, 1909
Superintendent, Crystal City Gas Company, 26 East Market Street, Corning, New York.

Gwynn, E. F.....May 18, 1909
President, Gwynn Gas Burner & Engineering Company, 713 Empire Building, Pittsburgh, Pennsylvania.

Hackstaff, John D.....June 12, 1906
General Manager, Empire Pipe Line Company, Bartlesville, Oklahoma.

Hackstaff, Richard C.....May 15, 1917
Empire Pipe Line Company, Bartlesville, Oklahoma.

Hadley, F. L.....May 16, 1911
Superintendent of Lines, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

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Hadley, W. R.....May 19, 1908
Secretary-Treasurer, The Union Natural Gas Corporation, 1606 Union Bank Building, Pittsburgh, Pennsylvania.

Hagen, O. C.....May 16, 1916
General Manager, Drilling Department, Ohio Fuel Supply Company, 75 Huffman Avenue, Columbus, Ohio.

Hagen, W. G.....May 18, 1915
Mechanical Engineer, The East Ohio Gas Company, 7918 Hough Avenue, Cleveland, Ohio.

Hall, C. T.....May 16, 1911
Oil and Gas Operator, Bula Oil Company, 74 Vandergrift Building, Pittsburgh, Pennsylvania.

Hall, Henry C.....May 15, 1917
General Bookkeeper, Iroquois Natural Gas Company, 72 Charlotte Avenue, Buffalo, New York.

Hall, Herman H.....May 16, 1916
Agent, The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Hall, Jesse J.....May 16, 1916
Accountant, Randall Gas Company, 190 Chancery Row, Morgantown, West Virginia.

Hall, T. A.....May 15, 1917
Engineer, Wichita Pipe Line Company, Bartlesville, Oklahoma.

Hamilton, W. R.....May 18, 1915
Petroleum and Mining Engineer, Pomeroy & Hamilton, 806 Hobart Building, San Francisco, California.

Hammon, M. E.....May 15, 1917
Foreman, South Shore Natural Gas & Fuel Company, 307 Central Avenue, Dunkirk, New York.

Hampton, Robert S.....May 15, 1917
President, Frankfort, Kentucky, Natural Gas Company, Titusville, Pennsylvania.

Hanks, J. G.....May 20, 1913
Superintendent, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

Hanley, T. Edward.....May 15, 1917
Superintendent, Hanley & Bird, 2 Main Street, Bradford, Pennsylvania.

Hann, Thomas D.....May 16, 1911
General Manager, Greensboro Gas Company, Brownsville, Pennsylvania.

Hannan, Robert W.....May 16, 1911
Oil and Gas Producer, 76-78 Vandergrift Building, Pittsburgh, Pennsylvania.

Hannon, D. W.....May 15, 1917
Division Foreman, East Ohio Gas Company, 1007 Garfield Avenue, S. W., Canton, Ohio.

Hare, A. S.....May 18, 1915
Cashier, The Natural Gas Company of West Virginia, 1226 Chaplin Street, Wheeling, West Virginia.

Hare, C. Willing.....May 17, 1910
Manager, New Business Department, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

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Harney, H., Jr......May 15, 1917
Inspector, Iroquois Natural Gas Company, 667 Genessee, Buffalo, New York.

Harrington, D. P......May 19, 1914
Assistant to General Superintendent, The Texas Company, Natural Gas Department, P. O. Drawer 983, Fort Worth, Texas.

Harrington, H. H......May 15, 1917
Superintendent, Citizens Gas & Electric Company, Elyria, Ohio.

Harris, George S......May 20, 1913
Chief Bookkeeper, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

Hartzell, A. C......May 19, 1908
Treasurer, Greenville Natural Gas Company, Canal Street, Greenville, Pennsylvania.

Harwood, J. Arch.....May 18, 1915
Civil Engineer, The Natural Gas Company of West Virginia, 41 Vine Street, Salem, Ohio.

Hastings, John.....May 16, 1916
Foreman, Iroquois Natural Gas Company, Hamburg, New York.

Hastings, William.....May 20, 1913
Division Superintendent, Iroquois Natural Gas Company, 306 Iroquois Building, Buffalo, New York.

Hawk, C. M......May 15, 1917
Chief Engineer, Logan Natural Gas & Fuel Company, Sugar Grove, Ohio.

Hawkins, B. L......May 16, 1916
Auditor, Eastern Oil Company, 312 Fidelity Building, Buffalo, New York.

Hay, Ralph W......May 18, 1909
Assistant General Superintendent and Purchasing Agent, The Manufacturers Light & Heat Company, 413 Columbia Bank Building, Pittsburgh, Pennsylvania.

Haymond, E. L......May 18, 1915
General Manager, Haymond Company, 103 South Mulberry Street, Muncie, Indiana.

Hays, Victor A......May 21, 1907
General Auditor, for Receiver, Kansas Natural Gas Company, Sixth and Maple Streets, Independence, Kansas.

Hazeltine, Roy S......May 16, 1916
Assistant Chief Geologist, Continental Oil & Gas Company, Box 578, Bartlesville, Oklahoma.

Hazlett, P. S......May 16, 1916
Foreman, Hope Natural Gas Company, West Union, West Virginia.

Hazlett, Ira I......May 16, 1916
Secretary, Jackson Pike Oil & Gas Company, New Lexington, Ohio.

Healy, F. R......May 18, 1915
Superintendent, Electrical Distribution, Union Gas & Electric Company, Fourth and Plum Street, Cincinnati, Ohio.

Healy, J. H......May 16, 1916
Assistant Treasurer, Potter Gas Company, 21 East Fortieth Street, New York, New York.

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Heard, T. J.....May 18, 1915
Secretary and Treasurer, Reserve Natural Gas Company, of Louisiana, 208 Ward Building, Shreveport, Louisiana.

Heasley, Harry.....May 16, 1911
President, Oklahoma Fuel Supply Company, 11½ Main Street, Tulsa, Oklahoma.

Heath, C. R.....May 19, 1908
President, Middletown Gas Company, Middletown, Indiana.

Heaton, R. L.....May 22, 1918
Assistant Chief Geologist, Medina Gas & Fuel Company, Box 134, Wooster, Ohio.

Heaziett, Frank.....May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, Blairsville, Pennsylvania.

Heaziett, William.....May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, Latrobe, Pennsylvania.

Heck, A. S.....May 18, 1915
Manager, Goff and Heck, Spencer, West Virginia.

Hegerty, F. P.....May 16, 1911
Representative, Westinghouse Electric & Manufacturing Company, 1808 Union Bank Building, Pittsburgh, Pennsylvania.

Heggem, A. G.....May 16, 1916
Petroleum Engineer, Consulting, 512-513 Danial Building, Tulsa, Oklahoma.

Helm, Charles L.....May 20, 1913
Agent, The East Ohio Gas Company, 137 Public Square, Wooster, Ohio.

Henderson, James.....May 22, 1918
District Foreman, Peoples Natural Gas Company, Imperial, Pennsylvania.

Henderson, James Alexander Leo.....May 16, 1911
Director and Technical Adviser, New Brunswick Gas & Oil Fields Company, Ltd., 3 London Wall Building, London, E. C., England.

Henderson, John I.....May 16, 1916
Engineer, The Logan Natural Gas Company, 34 Ruggery Building, Columbus, Ohio.

Hennessy, George F.....May 16, 1916
United Fuel Gas Company, 1810 McClung Street, Charleston, West Virginia.

Henning, J. A.....May 15, 1917
Clerk, Manufacturers Gas Company, Kane, Pennsylvania.

Henning, M. H.....May 18, 1915
Superintendent, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Herr, J. P.....May 16, 1916
Advertising Manager, Tulsa Daily World, Tulsa, Oklahoma.

Herring, A. W.....May 15, 1917
General Manager, The Commercial Oil & Gas Company, 172 Main Street, Ashtabula, Ohio.

Herron, F. W.....May 15, 1917
Secretary, Producers Gas Company, Olean, New York.

Heuperman, F. J.....May 18, 1915
Engineer, Calgary Gas Company, Limited, 215 Sixth Avenue, West, Calgary, Alberta, Canada.

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Heydrick, James C.....May 16, 1916
Box 596, Irvine, Kentucky.

Hickernell, George W.....May 15, 1917
Agent, Pennsylvania Gas Company, 213 Second Avenue, Warren, Pennsylvania.

Higgins, W. C.....May 20, 1913
Manager, Contract Department, The East Ohio Gas Company, East Ohio Gas Building, Cleveland, Ohio.

Hildabrand, J. S.....May 16, 1916
Field Superintendent, South Hills Oil & Gas Company, R. F. D. No. 6, Mt. Oliver, Pennsylvania.

Hildebrand, H. D.....May 19, 1914
President, Hope Engineering & Supply Company, 1319 Farmers Bank Building, Pittsburgh, Pennsylvania.

Hill, Charles E.....May 18, 1915
Colonial Building, Winchester, Kentucky.

Hill, Dudley M.....May 16, 1916
Assistant to Mechanical Engineer, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Hill, J. B.....May 16, 1911
Manager, Welsbach Company, 621 Liberty Avenue, Pittsburgh, Pennsylvania.

Hilty, John.....May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, 17th Street and 11th Avenue, Altoona, Pennsylvania.

Hinerman, George L.....May 19, 1914
Division Superintendent, Philadelphia Company of West Virginia, Weston, West Virginia.

Hines, Jesse W.....May 22, 1918
Chief Dispatcher (Gas), Empire Gas & Pipe Line Company, 100 No. Creek, Bartlesville, Oklahoma.

Hitchcock, Otto G.....May 18, 1908
Secretary and General Manager, Hays Manufacturing Company, 12th and Liberty Streets, Erie, Pennsylvania.

Hockstetter, Ralph.....May 15, 1917
Gas Producer, Gunsburg & Forman, Fidelity Building, Buffalo, New York.

Hodge, W. H.....May 15, 1917
Publicity Manager, H. M. Byllesby & Company, 208 South LaSalle Street, Chicago, Illinois.

Hoffman, H. R.....May 15, 1917
Chief Clerk, Iroquois Natural Gas Company, 131 Monroe Street, Buffalo, New York.

Hogg, Herman B.....May 18, 1915
Vice President, The National Supply Company of Pennsylvania, 314 Market Street, Parkersburg, West Virginia.

Holbrook, David Oliver.....May 19, 1908
Secretary-Treasurer, Natural Gas Association of America, President, Association of Natural Gas Supply Men, 904-905 Oliver Building, Pittsburgh, Pennsylvania.

Holland, H. T.....May 15, 1917
Chief Engineer, Wheeler Compressing Station, The Northwestern Ohio Natural Gas Company, Sugar Grove, Ohio.

Holly, W. M.....May 15, 1917
Field Superintendent, Potter Gas Company, Shinglehouse, Pennsylvania.

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Holmes, A. G.....June 12, 1906
Vice President and Manager, Pittsburgh Meter Company, P. O. Box 252, East Pittsburgh, Pennsylvania.

Holtz, W. H.....May 20, 1913
Chief Clerk, General Office, The East Ohio Gas Company, 1447 East Sixth Street, Cleveland, Ohio.

Hoover, H. J.....May 20, 1913
Commercial Manager, Gas Department, The Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Hopp, Henry C.....May 16, 1911
Manager, Malta & McConnellsville Gas Company, Malta, Ohio.

Horn, William.....May 22, 1918
General Manager, Sure Oil & Gas Company, 523 Fourth Street, Marietta, Ohio.

Hornor, Boyd E.....May 16, 1911
General Manager, Comet Oil & Gas Company, 225 West Pike Street, Clarksburg, West Virginia.

Hornor, Lynn S.....May 16, 1911
President, Norwood Gas Company, Clarksburg, West Virginia.

Horsley, George H.....May 16, 1916
Purchasing Agent, East Ohio Gas Company, 1290 West 103rd Street, Cleveland, Ohio.

Horton, F. J.....May 19, 1908
General Manager, Portland Gas & Pipe Line Company, 402 South Elm Street, Iola, Kansas.

Hottinger, R. L.....May 18, 1909
Meter Repairer, Logan Natural Gas & Fuel Company, 534 Second Street, Fremont, Ohio.

Hottle, A. G.....May 16, 1916
Superintendent, Arco Oil Company, South Street, Wooster, Wayne County, Ohio.

Hovis, Park.....May 16, 1916
Gas Well Driller and Inventor, Wooster, Ohio.

Hovis, W. A.....May 16, 1916
Foreman, United Natural Gas Company, Clermont, Pennsylvania.

Howard, G. E.....May 18, 1915
Master Mechanic, The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Howard, J. W.....May 15, 1917
Field Foreman, Medina Gas Company, Vienna, Ontario, Canada.

Howard, R. B.....May 16, 1916
Agent, Hope Natural Gas Company, 17 Clarksburg Street, Mannington, West Virginia.

Howard, W. C.....May 15, 1917
Foreman, Brantford Gas Company, Limited, 315 Colborne Street, Brantford, Ontario, Canada.

Hoyte, Walter S.....May 21, 1907
Flint Hills Oil & Gas Company, P. O. Box 448, Wichita, Kansas.

Huff, C. F.....May 20, 1913
Superintendent, The Clarion Gas Company, Clarion, Pennsylvania.

Hughes, William K.....May 21, 1912
Vice President, The Continental Supply Company, 918 Third National Bank Building, St. Louis, Missouri.

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Hull, H. D. ..... May 18, 1915
Field Superintendent, The Medina Gas & Fuel Company, Wooster, Ohio.

Humphreys, Alexander C. ..... May 21, 1912
President, Stevens Institute of Technology and Humphreys & Miller, Inc., 165 Broadway, New York, New York.

Hunter, Campbell M. ..... May 20, 1913
Oil Mining Expert, 3 and 4 Lothbury, London, E. C., England.

Hunter, W. E. ..... May 15, 1917
Vice President, Randall Gas Company, Morgantown, West Virginia.

Hurd, Franklin R. ..... May 15, 1917
General Clerk, East Ohio Gas Company, 1442 East 109th Street, Cleveland, Ohio.

Hurlburt, Alfred ..... May 16, 1911
Engineer, Kansas City Gas Company, 910 Grand Avenue, Kansas City, Missouri.

Hutchinson, Frank R. ..... May 20, 1913
Sales Manager, The Gas Appliance Company, 713 Frankfort Avenue, West, Cleveland, Ohio.

Hutchinson, H. D. ..... May 16, 1911
Contractor, 60 Lincoln Street, Uniontown, Pennsylvania.

Hutchinson, J. E. ..... May 16, 1916
Auditor, Lone Star Gas Company, Praetoriam Building, Dallas, Texas.

Hutchinson, W. P. ..... May 18, 1915
Vice President and Sales Manager, The Sprague Meter Company, Bridgeport, Connecticut.

Hutchison, E. H. ..... May 18, 1915
Producer and Contractor, Harmony, Pennsylvania.

Hyatt, H. R. ..... May 22, 1918
Chief Engineer, Logan Natural Gas & Fuel Company, Box 23, Pavonia, Ohio.

Inghram, D. W. ..... May 16, 1916
Field Foreman, The Peoples Natural Gas Company, Burgettstown, Pennsylvania.

Irwin, J. W. ..... May 16, 1916
Manager, Ohio Pipe & Supply Company, West Park, Ohio.

Irwin, R. W. ..... May 15, 1917
Agent, The Ohio Fuel Supply Company, 120 South Detroit Street, Xenia, Ohio.

Isherwood, J. H. ..... May 15, 1917
Gasoline Operator, Potter Gas Company, Shinglehouse, Pennsylvania.

Ivory, E. D. ..... May 16, 1916
Industrial Department, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Jackson, G. H. ..... May 16, 1916
Gas Department, Monongahela Valley Traction Company, Fairmont, West Virginia.

Jacoby, H. L. ..... May 15, 1917
Foreman, Producers Gas Company, Olean, New York.

James, Robert C. ..... May 17, 1910
General Auditor, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

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Jarvies, T. B.....May 19, 1908
Secretary, Jarvies Gas Burner, Heating & Plumbing Company, 4022 Belleview Avenue, Kansas City, Missouri.

Jay, C. H.....May 16, 1916
General Auditor, Ohio Cities Gas Company, 135 North Front Street, Columbus, Ohio.

Jay, D. C.....May 18, 1915
Superintendent, Leasing Department, United Fuel Gas Company, Quarrier Street, Charleston, West Virginia.

Jenkins, Howard.....May 16, 1916
Chief Engineer, Hope Natural Gas Company, Hardy Apartments, Mechanic Street, Clarksburg, West Virginia.

Jimerson, Deo.....May 18, 1915
Chief Engineer, Columbia Gas & Electric Company, R. F. D. No. 1, Kenova, West Virginia.

Johnson, C. W.....May 15, 1917
Assistant to Vice President, Hope Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Johnson, Frank.....May 15, 1917
Fieldman, Iroquois Natural Gas Company, Hamburg, New York.

Johnson, Roswell H.....May 16, 1916
Consulting Geologist, Johnson & Huntley, 1039 Murrayhill Avenue, Pittsburgh, Pennsylvania.

Johnson, Russell A.....May 20, 1913
Purchasing Agent, Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Jones, Clement Ross.....May 16, 1916
Consulting Engineer, Randall Gas Company, Morgantown, West Virginia.

Jones, E. T.....May 15, 1917
Division Foreman, East Ohio Gas Company, Canton, Ohio.

Jones, George H.....May 20, 1913
Vice President, East Ohio Gas Company, 26 Broadway, New York, New York.

Jones, Hoyle.....May 18, 1915
Manager of Sales, LaBelle Iron Works, 605 R. A. Long Building, Kansas City, Missouri.

Jones, Hugh T.....May 21, 1912
Jones Gas Company, 225 West Main Street, Chanute, Kansas.

Jones, T. C.....June 12, 1906
President, The Delaware Gas Company, 68 North Sandusky Street, Delaware, Ohio.

Jones, Thomas J.....May 16, 1916
Superintendent, Hope Natural Gas Company, 330 Locust Street, Mannington, West Virginia.

Jones, T. J.....May 18, 1915
Manager, The Columbus Gas & Fuel Company, 135 North Front Street, Columbus, Ohio.

Jordan, E. W.....May 21, 1912
Gas Engineer, Bessemer Gas Eng. Company, Grove City, Pennsylvania.

Jordan, G. R.....May 18, 1915
Civil Engineer, Southwestern Gas & Electric Company, 116 Texas Street, Shreveport, Louisiana.

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Judge, W. J......May 20, 1913
Vice President, National Fuel Gas Company, 26 Broadway, New York, New York.

Kanitz, Jacques.....May 19, 1914
General Director, der Ingarischen Gasgluehlicht A. G., VI., Vacxikoruit 3, Budapest, Hungary.

Kay, J. M......May 16, 1916
Field Superintendent, Glenshaw Natural Gas Company, Glenshaw, Pennsylvania.

Keenan, J. E......May 16, 1916
District Foreman, Equitable Gas Company, 6306 Penn Avenue, Pittsburgh, Pennsylvania.

Kellogg, E. B......May 15, 1917
Superintendent, Alden-Batavia Natural Gas Company, 71 Main Street, Batavia, New York.

Kellogg, Franklin L......May 16, 1911
Field Manager, Ontario Gas Company, Honeoye Falls, New York.

Kellum, B. J......June 12, 1906
Manager, Western Department, Welsbach Company, 629 Washington Boulevard, Chicago, Illinois.

Kenney, A. E......May 16, 1916
President, Kenney Land & Oil Company, Box 564 Parkersburg, West Virginia.

Kennedy, J. J......May 16, 1911
General Manager of Sales, National Tube Company, Frick Building, Pittsburgh, Pennsylvania.

Kent, William T......May 22, 1918
Director, Tiona Gasoline Company, Brave, Pennsylvania.

Kerr, A. N......May 15, 1917
General Superintendent, Riverside Western Oil Company, 5575 Pocressett Street, Pittsburgh, Pennsylvania.

Kerr, T. H......May 18, 1915
Engineer, Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Ketchum, D. A......May 18, 1915
Assistant General Superintendent, United Fuel Gas Company, Quarrier Street, Charleston, West Virginia.

Ketler, W. G......May 16, 1916
Agent, The Peoples Natural Gas Company, 701 Center Street, Wilkinsburg, Pennsylvania.

Kidd, J. W......May 16, 1916
Chief Clerk, Hope Natural Gas Company, 477 Campbell Street, Wilkinsburg, Pennsylvania.

Kiesel, Charles.....May 15, 1917
Foreman, East Ohio Gas Company, 714 Robbins Avenue, Niles, Ohio.

Kightlinger, A. D......May 16, 1917
Field Foreman, The Manufacturers Light & Heat Company, 61 East Wheeling Street, Washington, Pennsylvania.

Kilpatrick, R. B......May 18, 1915
Superintendent, Windsor Gas Company, 202 Ouellette Avenue, Windsor, Ontario, Canada.

Kimmell, C. F......May 16, 1916
Division Superintendent, Manufacturers Gas Company, Marlin Building, Brookville, Pennsylvania.

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Kincheloe, L. G......May 16, 1916
Foreman, Hope Natural Gas Company, 319 St. Clair Avenue, Clarksburg, West Virginia.

King, E. J......May 18, 1915
Vice President, The Huntington Development & Gas Company, 928 Third Avenue, Huntington, West Virginia.

King, James.....May 16, 1916
Superintendent, Allegheny Heating Company, 603 West Diamond Street N. S., Pittsburgh, Pennsylvania.

King, W. S......May 16, 1916
Field Foreman, The Peoples Natural Gas Company, Murraysville, Pennsylvania.

Kingsley, T. C......May 16, 1916
Oil Producer, Kingsley & Burgess, Middlebourne, West Virginia.

Kinley, George A......May 16, 1916
Assistant to the Vice President, Hope Natural Gas Company, 1130 Ross Avenue, Wilkinsburg, Pennsylvania.

Kirk, F. W......May 21, 1912
Superintendent, Pipe Lines, Lone Star Gas Company, 807 First National Bank Building, Fort Worth, Texas.

Klein, L. C......May 15, 1917
Manager, West Park Office, Continental Supply Company, West Park, Ohio.

Kline, Virgil P......May 20, 1913
Division Superintendent, Hope Natural Gas Company, Parkersburg, West Virginia.

Klingensmith, J. M......May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, 116 Hawthorn Avenue, Greensburg, Pennsylvania.

Klise, John J......May 16, 1916
Treasurer and General Manager, The Klise, Eckstein, McCann Company, 332 East Fifth Street, Lancaster, Ohio.

Klumpp, John Bartleman.....May 19, 1908
Inspecting Engineer, United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

Knapp, Isaac N......May 21, 1912
116 Ardmore Avenue, Ardmore, Pennsylvania.

Knight, William H......May 19, 1908
General Manager, Cleveland Gas Meter Company, 2180 East 65th Street, Cleveland, Ohio.

Knowles, W. R......May 16, 1916
Superintendent Pressure Department, The East Ohio Gas Company, 10832 Greenlawn Avenue, Cleveland, Ohio.

Knox, Clark.....May 22, 1918
Salesman, Estate Stove Company, 73 North Linwood Avenue, Crafton, Pennsylvania.

Kohl, W. G......May 15, 1917
Agent, Logan Natural Gas & Fuel Company, 10 South Pleasant Street, Norwalk, Ohio.

Koontz, L. V......May 18, 1915
President, Koontz Oil & Gas Company, Clendenin, West Virginia.

Kramer, C. W......May 15, 1917
Chief Engineer, Arkansas Natural Gas Company, State Bank Building, Little Rock, Arkansas.

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Krause, Charles.....May 20, 1913
Inspector, The Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Krebs, Oscar C.....May 18, 1915
Superintendent of Construction, The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Krick, Kay C.....February 27, 1906
Vice President, The Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Krum, F. D.....May 22, 1918
Agent, Pennsylvania Gas Company, 1122 Peach Street, Erie, Pennsylvania.

Lackey, Frank.....May 18, 1915
Superintendent, Crescent Oil & Gas Company, Glenwillard, Pennsylvania.

Ladd, George T.....May 16, 1911
President, The George T. Ladd Company, 1620 Farmers Bank Building, Pittsburgh, Pennsylvania.

Lakamp, J. H.....May 20, 1913
General Superintendent, Operating Department, Union Gas & Electric Company, Fourth and Plum Street, Cincinnati, Ohio.

Lambing, J. A.....May 18, 1909
1023 Franklin Avenue, Wilkinsburg, Pennsylvania.

Landis, H. K.....May 16, 1916
Managing Editor, The Gas Age, 52 Vanderbilt Avenue, New York, New York.

Lane, W. H.....May 22, 1918
Civil Engineer, Logan Natural Gas & Fuel Company, 47 North Hudson, Columbus, Ohio.

Lansley, John W.....May 18, 1915
Secretary, Southwestern Gas & Electric Company, 1615 Harris Trust Building, Chicago, Illinois.

Larkham, W. E.....May 15, 1917
Foreman, Calgary Gas Company, 2022 Center Street, North, Calgary, Alberta, Canada.

Larkin, J. J.....May 17, 1910
Larkin Brothers, Bartlesville, Oklahoma.

Larkin, W. H.....May 18, 1909
Manager, Larkin & Company, Butler, Pennsylvania.

Lathrop, Alanson P.....May 17, 1910
President, American Light & Traction Company, The Equitable Building, 120 Broadway, New York, New York.

Laughlin, James P.....May 15, 1917
General Foreman, Street Department, The East Ohio Gas Company, 19 North High Street, Akron, Ohio.

Lavell, Lon.....May 16, 1916
Foreman, Hope Natural Gas Company, Fairview, West Virginia.

Law, C. H.....May 16, 1911
General Superintendent, Ridgway Light & Heat Company, 16 North Broad Street, Ridgway, Pennsylvania.

Law, Robert, Jr.....May 16, 1911
President, The Quapaw Gas Company, 21 East Fortieth Street, New York, New York.

Layton, Miles B.....May 16, 1911
General Manager, Manufacturers Light & Heat Company, 312 Columbia Bank Building, Pittsburgh, Pennsylvania.

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Leamy, Alan.....May 18, 1909
Manager, Middle West Department, Welsbach Company, 116-122 East Chestnut Street, Columbus, Ohio.

Leamon, William G.....May 16, 1917
Chemist, Medina Gas & Fuel Company, Liberty and Market Streets, Wooster, Ohio.

Leard, R. C.....May 18, 1915
Superintendent, United Fuel Gas Company, Kermit, West Virginia.

Leathers, Harry M.....May 22, 1918
Gas Meter Engineer, Cutler-Hammer Manufacturing Company, 2003-10 Farmers Bank Building, Pittsburgh, Pennsylvania.

Leathers, J. H.....May 16, 1916
Foreman, Equitable Gas Company, 306 Faller Apartments, Donora, Pennsylvania.

Lee, Thomas M.....May 20, 1913
Superintendent, Trunk Lines, The East Ohio Gas Company, Canton, Ohio.

LeFevre, Harry E.....May 17, 1910
Contractor and Stockholder, American Natural Gas Company, Lexington Avenue and 4th Street, Aspinwall, Pennsylvania.

Lege, Fred M., Jr.....May 22, 1918
First Vice President and General Manager, Lone Star Gas Company, Forth Worth, Texas.

Lehman, I. L.....May 16, 1916
Commercial Manager, The Dayton Gas Company, First and St. Clair Streets, Dayton, Ohio.

Leidicker, F. H.....May 16, 1916
Leidicker Tool Company, Marietta, Ohio.

Leight, Harry G.....May 16, 1916
Foreman, Meter Repair Department, Logan Natural Gas & Fuel Company, Mansfield, Ohio.

Leland, Edward D.....May 16, 1911
Superintendent, Compressing Stations, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Leland, R. M.....May 15, 1917
Assistant Superintendent of Compressing Stations, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Leonard, A. W.....May 19, 1908
General Manager, Oklahoma Fuel Supply Company, Box 938, Tulsa, Oklahoma.

Leonard, Charles F.....May 20, 1913
Gas Engineer, Public Service Commission, Second District, Albany, New York.

Leonard, John.....May 16, 1916
Field Superintendent, Manufacturers Gas Company, Kane, Pennsylvania.

Leonard, J. W.....May 15, 1917
Oil Producer, J. W. Leonard Oil Company, 339 East Bean Street, Washington, Pennsylvania.

Lepper, E. L.....May 16, 1916
Agent, Logan Natural Gas & Fuel Company, 111 East North Street, Fostoria, Ohio.

LeRoy, Frank O.....May 15, 1917
Chief Clerk Chart Department, Hope Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

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Leslie, Frederick C.....May 15, 1917
Auditor, The Manufacturers Light & Heat Company, 248 Fourth Avenue, Pittsburgh, Pennsylvania.

Lewis, A. H.....May 20, 1913
Agent, Fremont Gas, Electric Light & Power Company, Fremont, Ohio.

Lewis, Phil.....May 16, 1911
Foreman, The East Ohio Gas Company, 240 North Second Street, Cuyahoga Falls, Ohio.

Light, George.....May 18, 1915
Superintendent, Dayton Gas Company, 234 North St. Clair Street, Dayton, Ohio.

Lillie, Lewis.....May 21, 1907
Third Vice President and Treasurer, The United Gas Improvement Company, Broad and Arch Street, Philadelphia, Pennsylvania.

Lindsay, Robert J.....May 18, 1909
Secretary, Hope Engineering & Supply Company, 203 Cole Building, Tulsa, Oklahoma.

Lindsay, Roy.....May 15, 1917
Foreman, Dominion Natural Gas Company, Limited, Dunnville, Ontario, Canada.

Lindsay, W. R.....May 16, 1916
President, MacBetty Gasoline Company, P. O. Box 921, Tulsa, Oklahoma.

Little, Perry A.....May 15, 1917
Producer Natural Gas & Oil, White Building, Buffalo, New York.

Lobaugh, W. H.....May 15, 1917
Field Manager, Pavilion Natural Gas Company, Pavilion, New York.

Lockhart, Robert.....May 16, 1916
Ohio Fuel Oil Company, Charleston, West Virginia.

Loebell, Henry O.....May 16, 1916
Industrial Fuel Engineer, Henry L. Doherty & Company, 60 Wall Street, New York, New York.

Logue, James J.....May 16, 1916
Superintendent, Reserve Gas Company, 241 North River Avenue, Weston, West Virginia.

Lohr, G. C.....May 18, 1915
Agent, The East Ohio Gas Company, 37 Main Street, Warren, Ohio.

Long, W. A.....May 16, 1916
Foreman, Arkansas Natural Gas Company, Vivian, Louisiana.

Longenecker, W. C.....May 16, 1911
Treasurer, Toledo Pipe Threading Machine Company, 1445 Summit Street, Toledo, Ohio.

Lord, R. S.....May 18, 1909
Vice President and Treasurer, Hope Engineering & Supply Company, Mount Vernon, Ohio.

Loveland, Elmer.....May 18, 1909
Superintendent, Logan Natural Gas & Fuel Company, 511 Sandusky Avenue, Fremont, Ohio.

Loveridge, Guy H.....May 15, 1917
Chief Clerk, Land Department, Iroquois Natural Gas Company, 33 Inwood Place, Buffalo, New York.

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Lowry, Frank M.....May 18, 1915
President and General Manager, Dominion Natural Gas Company, 842 Marine National Bank Building, Buffalo, New York.

Luebecker, Paul.....May 15, 1917
Compressing Station Department, Manufacturers Light & Heat Company, 1417 Chaplin Street, Wheeling, West Virginia.

Lupher, Preston W.....May 18, 1908
Vice President, The Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Luther, George M.....May 16, 1916
Foreman, The Manufacturers Light & Heat Company, 802 Third Street, Moundsville, West Virginia.

Lutz, Carl H.....May 15, 1917
Civil Engineer, Dominion Natural Gas Company, 842 Marine National Bank Building, Buffalo, New York.

Lynch, G. D.....May 15, 1917
Stock Man, Dominion Natural Gas Company, 209 Washington Avenue, Batavia, New York.

Lynn, James T.....May 21, 1907
President, Portsmouth (Ohio) Gas Company, 1711 Ford Building, Detroit, Michigan.

Lyon, J. F.....May 16, 1916
Meter Inspector, T. W. Phillips Gas & Oil Company, Butler, Pennsylvania.

Lyon, M. P.....May 18, 1915
Oil and Gas Broker, Hotel Tulsa, Tulsa, Oklahoma.

Lytle, M. E.....May 16, 1911
Superintendent, The Ohio Fuel Supply Company, 977 Bryden Road, Columbus, Ohio.

Macbeth, Alexander B.....May 21, 1907
Vice President and General Manager, Southern California Gas Company, 805 Garland Building, Los Angeles, California.

Mackie, Donald W.....May 22, 1918
Manager, Bradford Supply Company, 416 Pennsylvania Avenue, West, Warren, Pennsylvania.

Mahan, G. F.....May 21, 1907
Vice President, National Supply Company of Kansas, Independence, Kansas.

Mahoney, John T.....May 15, 1917
President, Commercial Oil Company, 17 Main Street, Buffalo, New York.

Mallory, L. E.....May 21, 1912
Oil and Gas Business, L. E. Mallory & Son, Bradford, Pennsylvania.

Maloney, J. L.....May 15, 1917
District Superintendent, Central Ohio Gas & Electric Company, Box 390, Wooster, Ohio.

Manning, William E.....May 16, 1911
General Manager of Sales, Youngstown Sheet & Tube Company, Stambaugh Building, Youngstown, Ohio.

Mansfield, J. P.....May 20, 1913
Superintendent, United Natural Gas Company, Van, Pennsylvania.

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Marckworth, W. C.....May 15, 1917
President and General Manager, Mountain State Gas Company, Union Trust Building, Charleston, West Virginia.

Markley, Joseph C.....May 19, 1914
Treasurer, Southwestern Gas and Electric Company, 111 West Monroe, Chicago, Illinois.

Marple, M. R.....May 16, 1916
Storekeeper, Equitable Gas Company, 23rd and Liberty Streets, Pittsburgh, Pennsylvania.

Marquis, H. H.....May 15, 1917
Manager, Kane Supply Company, 43 Fraley Street, Kane, Pennsylvania.

Marriott, W. J.....May 15, 1917
Foreman, Dominion Natural Gas Company, Ltd., Galt, Ontario, Canada.

Marston, Edgar J.....May 15, 1917
Treasurer, Texas & Pacific Coal Company, New York Office, 24 Broad Street, New York, New York; Thurber, Texas.

Martin, Edward P.....May 20, 1913
Agent, The East Ohio Gas Company, 124 North Chestnut Street, Ravenna, Ohio.

Martin, F. W.....May 16, 1916
Agent, Hope Natural Gas Company, 710 Wells Street, Sistersville, West Virginia.

Martin, Henry.....May 15, 1917
Oil Producer, J. W. Leonard Oil Company, 28 South Wade Avenue, Washington, Pennsylvania.

Martin, James.....May 20, 1913
Superintendent No. 2 Works, The East Ohio Gas Company, East 62nd Street & L. S. & M. S. R. R., Cleveland, Ohio.

Martin, J. O.....May 16, 1916
Contracting Agent, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Martin, John.....May 20, 1913
President, Midway Gas Company, 332 Pine Street, Room 411, San Francisco, California.

Mascho, Charles W.....May 20, 1913
Vice President, The National Supply Company, 136 Huron Street, Toledo, Ohio.

Mason, Alphonso.....May 18, 1909
Representative, Welsbach Company, Gloucester City, New Jersey.

Mason, John F.....May 20, 1913
Superintendent of Distribution, United Natural Gas Company, 308 Seneca Street, Oil City, Pennsylvania.

Mason, Sidney.....May 17, 1910
President, Welsbach Company, Gloucester City, New Jersey.

Mason, W. K.....May 22, 1918
Division Superintendent, Carnegie Gas Company, 1200 Seventh Street, Moundsville, West Virginia.

Matson, J. R.....May 20, 1913
Agent, The East Ohio Gas Company, 213 East Grant Street, Dennison, Ohio.

Maxon, Harry R.....May 18, 1915
President & General Manager, Maxon Premix Burner, Muncie, Indiana.

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Maxon, John H.....May 18, 1909
President and General Manager, The Central Indiana Gas Company, 301 East Main Street, Muncie, Indiana.

May, A. G.....May 16, 1916
217 Burris Street, Hamilton, Ontario, Canada.

McAllister, L. P.....May 18, 1915
Engineer, Columbia Gas & Electric Company, Branchland, West Virginia.

McBride, R. S.....May 16, 1916
Associate Chemist, Bureau of Standards, Washington, District of Columbia.

McCabe, John G.....May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, 1919 Forbes Street, Pittsburgh, Pennsylvania.

McCall, Edward P.....May 16, 1916
Drilling Contractor, C. W. McCall & Company, Second Street, Weston, West Virginia.

McCalmont, C. P.....May 20, 1913
Superintendent, Pennsylvania Gas Company, Clarion, Pennsylvania.

McCandless, C. H.....May 20, 1913
District Manager, United & Globe Rubber Manufacturing Companies, 914 Farmers Bank Building, Pittsburgh, Pennsylvania.

McCandless, H. E.....May 15, 1917
Clinton Pipe Pulling Company, 1306 Edward Street, Cleveland, Ohio.

McCandless, Harry M.....May 15, 1917
Agent, United Natural Gas Company, 12 South Brady Street, DuBois, Pennsylvania.

McCann, G. E.....May 15, 1917
Shop and Garage Foreman, Iroquois Natural Gas Company, 486 Massachusetts Avenue, Buffalo, New York.

McCarthy, F. R.....May 15, 1917
Redman Oil & Gas Company, 214 Kennedy Building Tulsa, Oklahoma.

McClellan, Arthur.....May 16, 1916
Superintendent of Construction, Peoples Natural Gas Company, 108 Orchard Street, Woodlawn, Pennsylvania.

McClellan, Joseph.....May 16, 1916
Orifice Meter Department, Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

McClintock, C. A.....May 15, 1917
Field Foreman, The East Ohio Gas Company, 429 Woodland Avenue, Wooster, Ohio.

McClintock, J. T.....May 18, 1915
President, Huntington Development & Gas Company, 928 Third Avenue, Huntington, West Virginia.

McCloskey, James P.....May 17, 1910
Superintendent, Columbia Gas & Electric Company, 814 Fourth Avenue, Huntington, West Virginia.

McCloy, S. D.....May 16, 1916
Contractor, Any Company, 323 Ridge Avenue, Canonsburg, Pennsylvania.

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McCloy, W. L......May 16, 1911
General Superintendent, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

McCluney, S. F......May 15, 1917
Chief Production Department, Oklahoma Natural Gas Company, 531 North Cheyenne Street, Tulsa, Oklahoma.

McConnell, H. H......May 16, 1916
Secretary and Treasurer, Pennsylvania Gas Company, 213 Second Avenue, Warren, Pennsylvania.

McCord, J. W......May 18, 1909
Secretary and General Manager, Clintonian Fuel & Oil Company, 511 National Bank of Commerce Building, Columbus, Ohio.

McCormick, Edward P......May 16, 1916
Foreman, Iroquois Natural Gas Company, 37 Church Street, Buffalo, New York.

McCormick, L. M......May 15, 1917
Foreman, East Ohio Gas Company, 37 Main Street, Warren, Ohio.

McCrea, R. A......May 16, 1911
Construction Engineer, Pittsburgh Valve, Foundry & Construction Company, Box 1016, Pittsburgh, Pennsylvania.

McCrimmon, J. E......May 15, 1917
Leaser, Dominion Natural Gas Company, Limited, St. Thomas, Ontario, Canada.

McCullough, G. W......May 22, 1918
Land Agent, Manufacturers Light & Heat Company, 907 Columbia Bank Building, Pittsburgh, Pennsylvania.

McCune, D. B......May 16, 1911
Agent, The Natural Gas Company of West Virginia, 34 Garfield Avenue, Salem, Ohio.

McCune, S. A......May 21, 1912
Superintendent Gas Production, Empire Gas & Fuel Company, Drawer "F", Bartlesville, Oklahoma.

McDonald, Donald.....May 20, 1913
Vice President and General Manager, Louisville Gas & Electric Company, 311 West Chestnut Street, Louisville, Kentucky.

McDowell, C. O......May 15, 1917
Superintendent, Kanawha Manufacturers' Gas Company, 502 Shrewsbury Street, Charleston, West Virginia.

McDowell, Jesse Clark.....February 27, 1906
President, Dominion Natural Gas Company, 1320 Farmers Bank Building, Pittsburgh, Pennsylvania.

McGilvary, H. J......May 16, 1916
Foreman, Pittsburgh & West Virginia Gas Company, 150 High Street, Weston, West Virginia.

McHenry, M. A......May 15, 1917
Lease Superintendent, Medina Gas & Fuel Company, Wooster, Ohio.

McIntyre, M......May 16, 1916
President and General Manager, Gowanda Natural Gas Company, 28 Main Street, Gowanda, New York.

McIlhenny, John D......May 17, 1910
President, Gas Company of Montgomery County (Norristown, Pa.), 1339 Cherry Street, Philadelphia, Pennsylvania.

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McKay, C. R.....May 18, 1915
Consulting Engineer, Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

McKee, George R.....May 16, 1916
Foreman, Consolidated Gas Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

McKee, William.....May 17, 1910
President, The Chaplin-Fulton Manufacturing Company, 34 Penn Avenue, Pittsburgh, Pennsylvania.

McKenzie, William Hunter.....February 27, 1906
General Manager, Wyandotte County Gas Company, Sixth and Main Avenue, Kansas City, Kansas.

McKimmie, J. E.....May 15, 1917
Purchasing Agent, Dominion Natural Gas Company, Limited, 842 Marine National Bank Building, Buffalo, New York.

McKinney, C. B.....May 15, 1917
Vice President and General Manager, North Texas Gas Company, 405, Gandy Street, Denison, Texas.

McKinney, R. A.....May 22, 1918
General Agent, The Manhattan Rubber Manufacturing Company, 475 Union Arcade Building, Pittsburgh, Pennsylvania.

McKnight, S. C.....May 20, 1913
Agent, The East Ohio Gas Company, Barberton, Ohio.

McMahon, D. P.....May 15, 1917
Agent, Buffalo, Iroquois Natural Gas Company, 37 Kenefick Avenue, Buffalo, New York.

McMahon, John.....May 20, 1913
Collector, Iroquois Natural Gas Company, 59 Dash Avenue, Buffalo, New York.

McMahon, John B.....May 18, 1915
Attorney, The Northwestern Ohio Gas Company, Spitzer Building, Toledo, Ohio.

McMahon, J. F.....May 20, 1913
Manager, Valley Natural Gas Company, P. O. Box W, Bakersfield, California.

McMahon, John J.....May 20, 1913
Superintendent Main Lines, The East Ohio Gas Company, Canton, Ohio.

McMahon, James W.....May 18, 1909
General Manager, The Northwestern Ohio Natural Gas Company, 210-212 Huron Street, Toledo, Ohio.

McMasters, W. C.....May 16, 1916
Clerk, Pittsburgh & West Virginia Gas Company, 610 Union Bank Building, Clarksburg, West Virginia.

McMillan, John.....May 20, 1913
Superintendent, United Fuel Gas Company, Clendenin, West Virginia.

McMillin, Emerson.....May 17, 1910
Chairman, Board of Directors, The American Light & Traction Company, 120 Broadway, New York, New York.

McMunn, J. S.....May 16, 1916
District Foreman, Equitable Gas Company, 108 Oakmont Avenue, Oakmont, Pennsylvania.

McNally, J. I.....May 18, 1915
Electrolysis Expert, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

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McNary, John B.....May 18, 1915
Manager, Canadian Meter Company, 88 and 90 Caroline Street, Hamilton, Ontario, Canada.

McNary, J. F.....May 19, 1914
Division Superintendent, Philadelphia Company of West Virginia, Union Bank Building, Clarksburg, West Virginia.

McNary, L. J.....May 16, 1916
Foreman, Reserve Gas Company, 343 North River Avenue, Weston, West Virginia.

McPherson, Edwin Allan.....May 15, 1917
301 Iroquois Building, Buffalo, New York.

Mead, Carl D.....May 16, 1916
Secretary-Treasurer, The Cadiz Gas Company, 114 North Main Street, Cadiz, Ohio.

Meals, S. W.....May 16, 1911
Carnegie Natural Gas Company, 816 Carnegie Building, Pittsburgh, Pennsylvania.

Machesney, C. A.....May 16, 1916
Engineer, Equitable Gas Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Meredith, George B.....May 16, 1916
Foreman, Hope Natural Gas Company, Smithfield, Pennsylvania.

Mellon, Porter D.....May 20, 1913
Engineer, Calgary Gas Company, Limited, 215 Sixth Avenue, West, Calgary, Alberta, Canada.

Merket, Joseph.....May 18, 1915
Superintendent, The Texas Company, Natural Gas Department, Box 298, Moran, Texas.

Merrill, Edwin C.....May 21, 1912
Manufacturer, 2915 Smallman Street, Pittsburgh, Pennsylvania.

Mettler, Lee B.....June 12, 1906
Lee-Huckins Hotel, Oklahoma City, Oklahoma.

Metz, Eugene.....June 12, 1906
Representative, Metric Metal Works, 419 Commerce Building, Kansas City, Missouri.

Michel, F. M.....May 16, 1916
Foreman, United Natural Gas Company, 119 West Weber Avenue, DuBois, Pennsylvania.

Mickley, M. A.....May 18, 1909
Agent, The Marion Gas Company, 238 East Winter Street, Marion, Ohio.

Miller, Alten S.....May 21, 1912
Engineer, The Bartlett Hayward Company, Baltimore, Maryland.

Miller, Carroll.....May 21, 1912
General Manager, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Miller, Dalton F.....May 15, 1917
Superintendent, Edgar M. Moore & Company, 709 Farmers Bank Building, Pittsburgh, Pennsylvania.

Miller, E. S.....May 21, 1912
Superintendent Gas Department, Kansas Gas & Electric Company, 239 South Main, Wichita, Kansas.

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Miller, Fred A.....May 19, 1908
President and General Manager, S. R. Dresser Manufacturing Company, 54 Boyeston Street, Bradford, Pennsylvania.

Miller, John A.....May 22, 1918
Chief Engineer, The Preston Oil Company, Pavonia, Ohio.

Miller, J. A. W.....May 15, 1917
Assistant Superintendent, Pittsburgh Plate Glass Company, Ford City, Pennsylvania.

Miller, L. L.....May 16, 1916
Foreman, Fayette County Gas Company, Walnut Street, Uniontown, Pennsylvania.

Miller, R. R.....May 16, 1916
Chief Clerk, Allegheny Heating Company, 603 West Diamond Street, North Side, Pittsburgh, Pennsylvania.

Miller, William A.....May 18, 1909
Engineer, National Chamber Oven Company, Cincinnati, Ohio.

Milne, W. E.....May 18, 1915
Manager, Gainesville Gas & Electric Company, 12 South Rusk Street, Gainesville, Texas.

Miner, Fred W.....May 18, 1909
Vice President, The National Supply Company, 1306 Union Bank Building, Pittsburgh, Pennsylvania.

Mitchell, C. S.....May 16, 1911
Controller, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Moeller, William, Jr.....May 19, 1908
Chief Engineer, Midway Gas Company, P. O. Box N, Taft, California.

Montgomery, J. H.....May 18, 1915
The Natural Gas Company of West Virginia, 96 Garfield Avenue, Salem, Ohio.

Moore, Calvin T.....May 15, 1917
Geologist, Henry L. Doherty & Company, Box 35, Winchester, Kentucky.

Moore, Edgar M.....May 18, 1915
Owner, Edgar M. Moore & Company, 709-710 Farmers Bank Building, Pittsburg, Pennsylvania.

Moore, Lee C.....May 16, 1911
President, Lee C. Moore & Company, 313 Sixth Avenue, Pittsburgh, Pennsylvania.

Moran, P. A.....May 16, 1916
District Foreman, Equitable Gas Company, 17th and Wharton Streets, Pittsburgh, Pennsylvania.

Morgan, W. J.....May 16, 1911
Agent, East Ohio Gas Company, 404 Tuscarawas Street, West, Canton, Ohio.

Morissey, P. J.....May 22, 1918
General Manager, Johnstown Fuel Supply Company, 535 Vine Street, Johnstown, Pennsylvania.

Morris, Henry C.....May 17, 1910
General Manager, The Dallas Gas Company, 1715 Commerce Street, Dallas, Texas.

Morse, Nathan L.....May 16, 1916
Purchasing Agent, Southern California Gas Company, 300 Garland Building, Los Angeles, California.

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Mowrey, John.....May 16, 1916
Foreman, Hope Natural Gas Company, Clay Street, Clarksburg, West Virginia.

Mueller, Fred B.....June 12, 1906
Vice President, H. Mueller Manufacturing Company, Decatur, Illinois.

Mulkin, P. L.....May 20, 1913
Agent, United Natural Gas Company, Meadville, Pennsylvania.

Munce, John Russell.....May 16, 1911
Vice President and General Manager, Arkansas Natural Gas Company, 1115 State Bank Building, Little Rock, Arkansas.

Munro, W. Lorne.....May 16, 1916
Auditor, Dominion Natural Gas Company, Main Street, Buffalo, New York.

Murphy, S. E.....May 22, 1918
Manager, Empire Gasoline Company, Drawer "F", Bartlesville, Oklahoma.

Murphy, S. F.....May 16, 1916
Foreman, United Natural Gas Company, Halsey, Mt. Jewett P. O., Pennsylvania.

Murray, Franklin C.....May 22, 1918
Representative, The B. F. Goodrich Rubber Company, Akron, Ohio.

Murray, John J.....May 16, 1911
Superintendent City Division, Equitable Gas Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Murray, M. J.....May 15, 1917
Foreman, East Ohio Gas Company, 503 East 127th Street, Cleveland, Ohio.

Murtaugh, James.....May 16, 1916
Field Superintendent, Ohio Fuel Supply Company, 760 East Main Street, Lancaster, Ohio.

Myers, E. E.....May 16, 1916
Agent, The Peoples Natural Gas Company, New Kensington, Pennsylvania.

Nash, John J.....May 18, 1915
General Manager, Huntington Development & Gas Company, 1428 Seventh Avenue, Huntington, West Virginia.

Nash, Raymond J.....May 16, 1916
Foreman, Huntington Development & Gas Company, 928 Third Avenue, Huntington, West Virginia.

Near, C. J.....May 15, 1917
Foreman, The Union Natural Gas Company, Essex, Ontario, Canada.

Near, W. W.....May 19, 1914
President, Page-Hersey Iron, Tube & Land Company, Ltd., 6603 Dominion Bank Building, Toronto, Ontario, Canada.

Neely, Ira L.....May 16, 1916
Superintendent, The Medina Gas & Fuel Company, Wooster, Ohio.

Neely, Lemon G.....May 18, 1909
President, The Berea Pipe Line Company, Saint Marys, Ohio.

Nelson, H. E.....May 15, 1917
Chief Engineer, Manufacturers' Gas Company, Erdice, Jefferson County, Pennsylvania.

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Nestor, J. F.....May 16, 1916
Chief Engineer, Manufacturers' Light & Heat Company, Wheeling, West Virginia.

Nestor, W. E.....May 20, 1913
Engineer, Manufacturers' Light & Heat Company, P. O. Box 607, Waynesburg, Pennsylvania.

Newhouse, B. Frank.....May 16, 1916
Service Clerk, Union Gas & Electric Company, Southwest Corner Fourth and Plum Streets, Cincinnati, Ohio.

Newman, A. J.....May 16, 1916
General Auditor, Union Natural Gas Corporation, 1607 Union Bank Building, Pittsburgh, Pennsylvania.

Newton, M. A.....May 16, 1916
Industrial Engineer, Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Newton, Nelson A.....May 18, 1915
Efficiency Engineer, The Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Nickerson, Henry B.....May 15, 1917
Secretary, American Steam Gauge & Valve Manufacturing Company, 208-220 Camden Street, Box 128, Back Bay, P. O., Boston, Massachusetts.

Nicoll, Thomas.....May 19, 1914
Treasurer, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Nicholson, French.....May 16, 1916
Foreman, Hope Natural Gas Company, Bridgeport, West Virginia.

Nole, E. P.....May 16, 1916
Field Foreman, The Peoples Natural Gas Company, Belle Vernon, Pennsylvania.

Nordensen, C. O.....May 22, 1918
Manager, Huessent Eng. Company, Oliver Building, Pittsburgh, Pennsylvania.

Norris, Henry S.....May 20, 1913
Secretary, Iroquois Natural Gas Company, Iroquois Building, Buffalo, New York.

Norris, Rollin.....May 21, 1907
General Superintendent, The United Gas Improvement Company, 1401 Arch Street, Philadelphia, Pennsylvania.

Northcott, G. A.....May 18, 1915
Treasurer, Huntington Development & Gas Company, 1344 Third Avenue, Huntington, West Virginia.

Northup, Charles S.....May 18, 1915
Attorney, The Northwestern Ohio Natural Gas Company, Spitzer Building, Toledo, Ohio.

Norton, Charles L.....May 20, 1913
Manager, George C. Moon Company, Inc., 872 Rockefeller Building, Cleveland, Ohio.

O'Brien, Thomas F.....May 16, 1916
Agent, United Fuel Gas Company, Court Street, Spencer, West Virginia.

O'Brian, T. F.....May 19, 1914
Superintendent, The Texas Company, Natural Gas Department, Drawer 44, Shreveport, Louisiana.

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O'Brien, William.....May 19, 1914
President, O'Brien Steel Construction Company, Washington, Pennsylvania.

O'Connor, T. M.....May 20, 1913
Stockkeeper, The East Ohio Gas Company, East 62nd Street and Lake Shore Railway, Cleveland, Ohio.

O'Day, John J.....May 16, 1916
Agent, The Manufacturers' Light & Heat Company, 620 Maple Lane, Sewickley, Pennsylvania.

Odenkirk, H. B.....May 16, 1916
Developer of Oil and Gas, East Liberty Street, Wooster, Ohio.

O'Donnell, John L.....May 19, 1908
The Hanna Oil Company, Tulsa, Oklahoma.

O'Leary, Dennis.....May 20, 1913
Chief Engineer, Pennsylvania Gas Company, Lodlow, Pennsylvania.

Oliphant, Bert C.....May 21, 1912
President, Iroquois Natural Gas Company, 45 Church Street, Buffalo, New York.

Oliphant, F. H.....May 15, 1917
Assistant Engineer, Iroquois Natural Gas Co., 812 Auburn Avenue, Buffalo, New York.

Olmstead, J. F.....May 16, 1916
Superintendent of Distribution, The Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Oliver, C. E.....May 20, 1913
Chief, Pressure Department, United Natural Gas Company, 206 Seneca Street, Oil City, Pennsylvania.

Olney, George L.....May 15, 1917
Superintendent Building Construction, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

O'Neill, Charles.....May 21, 1907
Superintendent of Distribution, Webb City & Carterville Gas Company, Carthage Gas Company, Webb City Missouri.

Ossenbeck, Fred J.....May 21, 1912
General Contracting, Bliss Building, Tulsa, Oklahoma.

Ostermaier, John.....May 16, 1916
District Foreman, Equitable Gas Company, 23rd Street and Liberty Avenue, Pittsburgh, Pennsylvania.

Ostrye, Peter L.....May 16, 1916
Superintendent, Meter Department, East Ohio Gas Company, Hendon Avenue, West Park, Cleveland, Ohio.

Owens, J. F.....May 22, 1918
General Manager, Muskogee Gas & Electric Company, 23-25 West Okmulgee Avenue, Muskogee, Oklahoma.

Painter, Jay C.....May 15, 1917
Cashier, Oklahoma Natural Gas Company, Pioneer Building, Tulsa, Oklahoma.

Palm, C. J.....May 16, 1916
Superintendent, Lease Department, Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Palmer, J. F.....May 16, 1916
General Superintendent, Arkansas Natural Gas Company, Ward Building, Shreveport, Louisiana.

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Palmer, William M.....May 18, 1915
Assistant Superintendent, Southwestern Gas & Electric Company, 116 Texas Street, Shreveport, Louisiana.

Pannabecker, W. A.....May 22, 1918
Superintendent, Preston Oil Company, Lancaster, Ohio.

Paris, A. J., Jr.....May 16, 1916
Treasurer and General Manager, Felt Gas Compressing Company, Bradford, Pennsylvania.

Parks, R. N.....May 18, 1915
Superintendent Gasoline Stations, United Fuel Gas Company, Quarrier Street, Charleston, West Virginia.

Parr, Adrian T.....May 15, 1917
Chief Draftsman, Geological Department, Medina Gas & Fuel Company, 428 North Bever Street, Wooster, Ohio.

Parsons, J. E.....May 22, 1918
General Auditor, The Ohio Fuel Supply Company, 2017 Farmers Bank Building, Pittsburgh, Pennsylvania.

Patterson, A. B.....May 19, 1914
Manager, New York Belting Packing Company, 420 First Avenue, Pittsburgh, Pennsylvania.

Patterson, William M.....May 18, 1909
In Charge of Pipe Department, Frick Lindsay Company, 109 Wood Street, Pittsburgh, Pennsylvania.

Pattinson, R. L.....May 19, 1914
President, Medina Natural Gas Company, 29 Fifth Street, Chatham, Ontario, Canada.

Payne, A I.....
Calgary, Alberta, Canada.

Payne, Christy.....May 18, 1915
Attorney and Secretary, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Payne, Francis H.....May 20, 1913
Manager, Metric Metal Works, Post Office Box 710, Erie, Pennsylvania.

Pearson, C. A.....May 15, 1917
Master Mechanic, United Natural Gas Company, Oil City, Pennsylvania.

Pearson, H. B.....May 19, 1914
General Superintendent, Calgary Gas Company, Limited, 215 Sixth Avenue, Calgary, Alberta, Canada.

Peddicord, T. B.....May 18, 1915
Foreman, Pittsburgh & West Virginia Gas Company, 382 Broaddus Avenue, Clarksburg, West Virginia.

Peden, D. V.....May 22, 1918
Secretary to the President, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

Penhale, J. W.....May 18, 1915
Superintendent, United Fuel Gas Company, Quarrier Street, Charleston, West Virginia.

Perdue, J. L.....May 16, 1916
Chief Engineer, United Fuel Gas Company, Charleston, West Virginia.

Perry, E. R.....May 15, 1917
Cosden Oil & Gas Company, Tulsa, Oklahoma.

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Pew, James G.....May 16, 1916
Superintendent, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Pew, John G.....May 20, 1913
Vice President and General Manager, Sun Shipbuilding Company, Philadelphia, Pennsylvania.

Phillips, C. C.....May 18, 1915
Chief Clerk, Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Phillips, D. H.....May 15, 1917
Agent, Potter Gas Company, Port Allegany, Pennsylvania.

Phillips, Henry T.....May 16, 1916
Gas Magazine, Service Publishing Company, 179 East Long Street, Columbus, Ohio.

Pick, Earle.....May 16, 1916
Agent, The Peoples Natural Gas Company, 448 Walnut Avenue, Greensburg, Pennsylvania.

Plagenz, George W.....May 18, 1915
Secretary to Secretary-Treasurer, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

Poole, C. J.....May 16, 1916
Agent, Fayette County Gas Company, 302 South Pittsburgh Street, Connellsville, Pennsylvania.

Pope, Worden.....May 16, 1916
Engineer, Henry L. Doherty & Company, 60 Wall Street, New York, New York.

Porter, C. E.....
Manager, Furnace Department, Standard Sanitary Manufacturing Company, Pittsburgh, Pennsylvania.

Porterfield, Harry.....May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, 707 Center Street, Wilkinsburg, Pennsylvania.

Pratt, Charles E.....May 16, 1916
Foreman, Equitable Gas Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Pratt, Edward G.....May 21, 1912
Consulting and Managing Gas Engineer, 122 South Michigan Avenue, Chicago, Illinois.

Presho, A. A.....May 15, 1917
Agent, Potter Gas Company, Westfield, Pennsylvania.

President.....May 18, 1915
Direccion General Explotacion del Petroleo de Comodoro Rivadava, 278 Balcarce, Buenos Aires, Argentine.

Preston, S. C.....May 16, 1916
Chief Engineer, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Price, W. W.....May 18, 1909
President, Dayton Pipe Coupling Company, Edmun Street, Dayton, Ohio.

Prior, Charles J.....May 20, 1913
Assistant to Manager, Metric Metal Works, 339 East 7th Street, Erie, Pennsylvania.

Prill, H. M.....May 15, 1917
Cashier, Warren & Chautauqua Gas Company, 236 Pennsylvania Avenue, West, Warren, Pennsylvania.

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Pringle, R. S.....May 15, 1917
Manager, Pringle Power Company, 139 Main Street, Bradford, Pennsylvania.

Pryor, F. B.....May 16, 1911
Superintendent, Gas Department, Monongahela Valley Traction Company, Fairmont, West Virginia.

Purdy, J. S. L.....May 19, 1914
General Manager, The Pavilion Natural Gas Company, 68 Main Street, LeRoy, New York.

Pyzel, E. D.....May 17, 1910
Manager, Petrie & Company, Keizersgracht 642-644, Amsterdam, Holland.

Quay, H. A.....May 18, 1915
District Manager, Manufacturers' Light & Heat Company, Columbia Bank Building, Pittsburgh, Pennsylvania.

Quinlan, P. J.....May 16, 1916
Shop Foreman, The River Gas Company, 228 Third Street, Marietta, Ohio.

Quinlin, Ambrose J.....May 20, 1913
General Foreman, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

Rae, A. B.....May 20, 1913
Foreman, The East Ohio Gas Company, 4706 Lorain Avenue, Cleveland, Ohio.

Ralph, Charles A.....May 18, 1915
Ralph Brothers, Aspinwall, Pennsylvania.

Ralston, William S.....May 18, 1909
Vice President, Chaplin-Fulton Manufacturing Company, 34 Penn Street, Pittsburgh, Pennsylvania.

Ramage, J. R.....May 16, 1916
Gas Salesman, Louisville Gas & Electric Company, 311 West Chestnut Street, Louisville, Kentucky.

Ramsey, E. C.....May 15, 1917
Engineer in Charge of Field Pressure, Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Randolph, Ernest.....May 19, 1914
Oil and Gas Operator, 510 Goff Building, Clarksburg, West Virginia.

Randolph, M. D.....May 16, 1916
Manager, Arkansas Natural Gas Company, Pine Bluff, Arkansas.

Rankin, Harvey.....May 16, 1916
Head Leaseman, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Ratcliffe, George W.....May 21, 1912
Treasurer, Manufacturers' Light & Heat Company, 248 Fourth Avenue, Pittsburgh, Pennsylvania.

Rearick, Jesse.....May 22, 1918
Chief Engineer, Logan Natural Gas & Fuel Company, R. F. D. No. 6, Mt. Vernon, Ohio.

Reed, Charles C.....May 16, 1916
Superintendent Gasoline Department, Hope Natural Gas Company, 310 Despard Street, Clarksburg, West Virginia.

Reed, F. L.....May 16, 1916
Agent, The River Gas Company, 324 Fourth Street, Marietta, Ohio.

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Reed, Ira B.....May 15, 1917
Assistant Secretary and Treasurer, Iroquois Natural Gas Company, 45 Church Street, Buffalo, New York.

Reed, J. A.....May 16, 1911
Assistant General Superintendent, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Reed, James H.....May 16, 1916
President, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Reed, J. H., Jr.....May 16, 1911
General Purchasing Agent, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Reeser, E. B.....May 20, 1913
General Manager, Potter Gas Company, 21 East 40th Street, New York, New York.

Reeser, F. B.....May 18, 1915
Superintendent, The Miami Valley Gas & Fuel Company, Wayne Street, Piqua, Ohio.

Reeser, J. W.....May 19, 1914
General Superintendent, United Fuel Gas Company, 515 Sixth Street, Huntington, West Virginia.

Reichel, C. D.....May 20, 1913
Information and Complaint Clerk, The Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Reichert, Wm.....May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, Wilkinsburg, Pennsylvania.

Reiley, J. M.....May 15, 1917
Gas Appliance Exhibit, Iroquois Natural Gas Company, Iroquois Building, Buffalo, New York.

Reiser, Charles L.....May 15, 1917
Station Engineer, Iroquois Natural Gas Company, Collins Center, New York.

Remler, J. E.....May 15, 1917
Superintendent, Compressor Station, Kansas Gas Company, Independence, Kansas.

Renick, J. D.....May 16, 1916
Inspector, Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Rich, A. R.....May 18, 1915
Superintendent, The Ohio Cities Gas Company, West Virginia Division, Dawes, Kanawha County, West Virginia.

Rich, Edward B.....May 16, 1911
President, University Oil Company, P. O. Box 628, Parkersburg, West Virginia.

Richards, W. H.....May 16, 1916
Treasurer, Potter Gas Company, Port Allegany, Pennsylvania.

Richie, J. A.....May 15, 1917
Secretary-Treasurer, Dominion Natural Gas Company, Limited, 842 Marine Bank Building, Buffalo, New York.

Richter, William F.....May 16, 1916
Foreman, Fayette County Gas Company, Painter Street, South Connellsville, Pennsylvania.

Riddle, George B.....May 18, 1915
Superintendent, The Natural Gas Company of West Virginia, 1226 Chaplin Street, Wheeling, West Virginia.

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Ridgway, J. L......May 16, 1916
Field Foreman, The Peoples Natural Gas Company, Brave, Pennsylvania.

Riggs, Ross.....May 19, 1914
Field Foreman, Northeastern Oil & Gas Company, R. D. No. 1, Jefferson, Ohio.

Riley, George N.....May 16, 1911
Engineer, National Tube Company, Frick Building, Pittsburgh, Pennsylvania.

Ripley, L. O.....May 21, 1912
Vice President and General Manager, Kansas Gas & Electric Company, 237-239 South Main Street, Wichita, Kansas.

Roberts, C. C.....May 16, 1916
Superintendent, Southern Ontario Gas Company, 41 Queen Street, St. Thomas, Ontario, Canada.

Roberts, M. J.....May 15, 1917
Meter Tester, Beaver Oil & Gas Company, Limited, Kingsville, Ontario, Canada.

Roberts, W. T.....May 16, 1916
Inspector, Arkansas Natural Gas Company, Little Rock, Arkansas.

Robertson, D.....May 16, 1916
Treasurer, Pittsburgh Oil & Gas Company, 1005 Farmers Bank Building, Pittsburgh, Pennsylvania.

Robertson, D. S.....May 16, 1916
Superintendent, Jantha Light & Fuel Company, Greenville, Ohio.

Robertson, James D.....May 22, 1918
Representative, Pittsburgh Valve Foundry & Construction Company, Pittsburgh, Pennsylvania.

Robertson, John D.....May 21, 1912
Owner and Producer, Jacksonville, Illinois.

Robinson, Edwin.....May 18, 1915
Secretary-Treasurer, West Virginia Natural Gas Association, Jacobs Building, Fairmont, West Virginia.

Robinson, L. E.....May 21, 1912
General Manager, The Robinson Packer & Machine Company, 141 Spruce Street, Coffeyville, Kansas.

Roby, H. P.....May 15, 1917
Assistant Secretary-Treasurer, Interstate Pipe Company, 1523 Oliver Building, Pittsburgh, Pennsylvania.

Rogers, Homer R.....May 18, 1909
Agent, The Logan Natural Gas & Fuel Company, 29 South Washington Street, Tiffin, Ohio.

Romano, M.....May 16, 1916
Labor Supplied for Gas Companies, 119 Shetland Avenue, E. E., Pittsburgh, Pennsylvania.

Rooney, E. S.....May 18, 1909
District Sales Agent, The Youngstown Sheet & Tube Company, 1626 Oliver Building, Pittsburgh, Pennsylvania.

Rose, W. J.....May 20, 1913
Manager, Alliance Gas & Power Company, Alliance, Ohio.

Rothert, E. R.....May 18, 1915
Solicitor, Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

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Rowan, Raymond C.....May 15, 1917
Secretary to Vice President, The Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Rowland, Willard J.....May 16, 1911
President, Creek County Gas Company, 1913 First National Bank Building, Pittsburgh, Pennsylvania.

Rudert, Emil.....May 15, 1917
Contractor, Saxonburg, Pennsylvania.

Rumbaugh, G. N.....May 16, 1916
Drilling Contractor, Forest Drilling Company, 347 North Fountain Avenue, Wichita, Kansas.

Rupp, C. H.....May 18, 1915
Assistant Treasurer, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Rush, Albert.....May 15, 1917
Contractor Drilling, Manufacturers' Light & Heat Company, 805 East Main Street, Waynesburg, Pennsylvania.

Russell, C. H.....May 15, 1917
Chief Station Engineer, United Natural Gas Company, R. F. D. No. 1, Mt. Jewett, Pennsylvania.

Russum, R. C.....May 15, 1917
Secretary-Treasurer, Quapaw Gas Company, First National Bank Building, Bartlesville, Oklahoma.

Rutz, A. O.....May 16, 1916
General Manager, Milwaukee Gas Specialty Company, 133 Second Street, Milwaukee, Wisconsin.

Ryan, E. M.....May 15, 1917
Chief Gas Ledger Bookkeeper, Iroquois Natural Gas Company, 185 Hamburg Street, Buffalo, New York.

Ryan, J. L.....May 15, 1917
Agent, Salamanca, New York, Iroquois Natural Gas Company, Salamanca, New York.

Ryan, W. G.....May 16, 1916
Oil and Gas Producer, 322 Wellington Street, Chatham, Ontario, Canada.

Sackett, Edward.....May 16, 1916
Meter Engineer, United Fuel Gas Company, Quarrier Street, Charleston, West Virginia.

Saeger, E. L.....May 15, 1917
Foreman, East Ohio Gas Company, Barberton, Ohio.

Sands, Louis C.....May 18, 1909
Vice President, The Oil Well Supply Company, 215 Water Street, Pittsburgh, Pennsylvania.

Sarchet, A. C.....May 16, 1911
Agent, The Ohio Fuel Supply Company, 142 North 9th Street, Cambridge, Ohio.

Sargent, R. N.....May 15, 1917
Works Manager, The Roessler & Hasslacher Chemical Company, St. Albans, West Virginia.

Sartorius, F.....May 15, 1917
Treasurer, United Natural Gas Company, 308 Seneca Street, Oil City, Pennsylvania.

Saul, Milt.....May 18, 1915
Editor, Gas Record, 20 West Jackson Boulevard, Chicago, Illinois.

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de Saulles, C. A. H.....May 19, 1908
President and General Manager, United States Zinc Company, 120 Broadway, New York, New York.

Schaffer, Hose.....May 16, 1916
Foreman, The Manufacturers' Light & Heat Company, Washington, Pennsylvania.

Schalck, John H.....May 16, 1916
Meter Tester and Repairman, Manufacturers' Light & Heat Company, Millbridge and Manton Streets, Pittsburgh, Pennsylvania.

Schall, Henry D.....May 17, 1910
Assistant to Vice President, Detroit Stove Works, 1320-60 Jefferson Avenue, Detroit, Michigan.

Schatzel, G. P.....May 16, 1916
Agent, Logan Natural Gas & Fuel Company, 114 West Front Street, Findlay, Ohio.

Schauer, Frank F.....May 21, 1912
Assistant Engineer, Kansas City Gas Company, 910 Grand Avenue, Kansas City, Missouri.

Schell, George W.....May 17, 1910
Superintendent, Hope Engineering & Supply Company, Mayerstown, Lebanon County, Pennsylvania.

Schell, W. F.....May 18, 1915
Mechanical Engineer, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Schlaudecker, E. M.....May 20, 1913
Agent, Pennsylvania Gas Company, 312-314 Cherry Street, Jamestown, New York.

Schlosser, A. J.....May 16, 1916
Chief Engineer, Station Department, Potter Gas Company, Box 237, Shinglehouse, Pennsylvania.

Schmidt, Elmer F.....May 18, 1915
Assistant Engineer, The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Schneider, M. C.....May 19, 1914
Assistant to General Superintendent, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Schwarm, C. A.....May 21, 1907
Gas Engineer, 612 Union Trust Building, Detroit, Michigan.

Scott, G. C.....May 18, 1909
Secretary-Treasurer, The Columbus Gas & Fuel Company, 135 North Front Street, Columbus, Ohio.

Scott, John Milton.....May 18, 1909
Secretary-Treasurer, Kansas City Gas Company, 910 Grand Avenue, Kansas City, Missouri.

Scott, W. H.....May 16, 1911
Teller, The Northwestern Ohio Natural Gas Company, 210-212 Huron Street, Toledo, Ohio.

Scoville, James.....May 15, 1917
Foreman, The East Ohio Gas Company, 19-21 North High Street, Akron, Ohio.

Scratch, George.....May 15, 1917
Foreman, Beaver Oil & Gas Company, Limited, Kingsville, Ontario, Canada.

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Searle, Robert Meredith.....May 21, 1912
Vice President, Rochester Railway & Light Company, 34 Clinton Avenue, North, Rochester, New York.

Secrest, M. F.....May 16, 1916
Foreman, Arkansas Natural Gas Company, Hope, Arkansas.

Sedberry, W. H.....May 16, 1911
Manager, Terrebonne Gas Company, Houma, Louisiana.

Seem, Fred B.....May 22, 1918
Superintendent, Empire Gas & Pipe Line Company, 304 Chickasaw Street, Bartlesville, Oklahoma.

Seep, Joseph.....May 15, 1917
President, Central Kentucky National Gas Company, Oil City, Pennsylvania.

Seibel, John.....May 16, 1911
Night Watchman, Logan Natural Gas & Fuel Company, 612 North Cory Street, Findlay, Ohio.

Seibert, Charles.....May 22, 1918
Agent, Ohio Fuel Supply Company, New Lexington, Ohio.

Seyffert, L. A.....May 20, 1913
Treasurer, United Fuel Gas Company, Box 1256, Charleston, West Virginia.

Shafer, F.....May 15, 1917
Superintendent, Southern California Gas Company, Garland Building, Los Angeles, California.

Shaffer, D. C.....May 18, 1915
Superintendent Distribution, Union Light, Heat & Power Company, Court and Park Place, Covington, Kentucky.

Shannon, Ogden K.....May 17, 1910
Manager, The Fort Worth Gas Company, Eleventh and Throckmorton Street, Fort Worth, Texas.

Shattuck, J. R.....May 15, 1917
Engineer, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Shaw, S. T.....May 16, 1916
Agent, The Peoples Natural Gas Company, 343 Main Street, Latrobe, Pennsylvania.

Shay, J. W.....May 16, 1916
President, Greensboro Gas Company, 248 Fourth Avenue, Pittsburgh, Pennsylvania.

Shear, Robert.....May 16, 1911
Secretary, Home Gas Company, Mt. Morris, Pennsylvania.

Sheets, William L.....May 16, 1916
Clerk, Pittsburgh & West Virginia Gas Company, 608 East Center Street, Weston, West Virginia.

Sheppard, John C.....May 16, 1911
Superintendent, Chaplin-Fulton Manufacturing Company, 28-34 Penn Avenue, Pittsburgh, Pennsylvania.

Shepard, W. H.....May 19, 1908
Treasurer and Manager, Coffeyville Gas & Fuel Company, 112 West Eighth Street, Coffeyville, Kansas.

Sherlock, Amy (Miss).....May 20, 1913
Assistant Secretary, Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Shiebler, Marvin.....May 17, 1910
Consulting Gas Engineer, 80 Broadway, New York, New York.

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Shinnick, George S......May 16, 1916
Commercial Manager, Columbus Gas & Fuel Company, 135 North Front Street, Columbus, Ohio.

Short, C. L......May 15, 1917
Superintendent, Boone Territory, Mountain State Gas Company, P. O. Box "P", Peytona, West Virginia.

Shoub, John F......May 20, 1913
Secretary, The Delaware Gas Company, 68 North Sandusky Street, Delaware, Ohio.

Shoup, G. E......May 22, 1918
Agent, Medina Gas & Fuel Company, North Market Street, Wooster, Ohio..

Shriver, Ed......May 15, 1917
Foreman, East Ohio Gas Company, 127 North Chestnut Street, Ravenna, Ohio.

Shuiters, Hoyt V......May 21, 1912
Secretary and Treasurer, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

Silliman, L. V......May 16, 1916
Foreman, Philadelphia Company, 816 Mill Street, Tarentum, Pennsylvania.

Simmons, L. M......May 20, 1913
Agent, United Natural Gas Company, DuBois, Pennsylvania.

Simmons, W. P......May 16, 1916
Agent, The Manufacturers' Light & Heat Company, 34 South Wade Street, Washington, Pennsylvania.

Simpson, J. M......May 18, 1915
Assistant Purchasing Agent, The Ohio Fuel Supply Company, 2017 Farmers Bank Building, Pittsburgh, Pennsylvania.

Sinclair, E. W......May 21, 1907
President, Exchange National Bank, Tulsa, Oklahoma.

Singleton, Bert......May 16, 1916
Foreman, Hope Natural Gas Company, 310 Dancer Street, Clarksburg, West Virginia.

Sipe, George B......May 19, 1908
Vice President and General Manager, Louisiana Gas Company, Levy Building, Shreveport, Louisiana.

Sipe, William Everett......May 16, 1911
Manager, Atlanta Gas Company, Atlanta, Texas.

Siverling, J. L......May 16, 1916
Field Foreman, The Peoples Natural Gas Company, Elderton, Pennsylvania.

Slack, Charles W......May 15, 1917
Superintendent, The Attica Natural Gas Company, Attica, New York.

Sloan, C. M......May 15, 1917
Clerk, Shop, Iroquois Natural Gas Company, 108 Eighteenth Street, Buffalo, New York.

Sloan, C. T......May 15, 1917
Chief Engineer, Pennsylvania Gas Company, Warren, Pennsylvania.

Sloan, F. M......May 16, 1916
Operator, Murraysville, Pennsylvania.

Sloan, J. A......May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, Portage, Pennsylvania.

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Sloan, W. L......May 15, 1917
Foreman, Station Men, Iroquois Natural Gas Company, 81 Buffum Street, Buffalo, New York.

Sloane, P. C......May 16, 1916
Agent, United Fuel Gas Company, Quarrier Street, Charleston, West Virginia.

Slogle, B......May 15, 1917
Oil and Gas Producer, Continental Supply Company, West Park, Ohio.

Smies, George H......May 20, 1913
Chief Clerk, The Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Smith, A. C......May 16, 1916
Operator, 507 Virginia Street, Charleston, West Virginia.

Smith, Elmer A......May 16, 1916
Auditor, American Natural Gas Company, 1511 Park Building, Pittsburgh, Pennsylvania.

Smith, Ernest B......May 18, 1909
Manager, The Coshocton Gas Company, Bachert Building, Coshocton, Ohio.

Smith, Edward......May 18, 1915
Chief Clerk, Well Accounting Department, The East Ohio Gas Company, 1513 Lincoln Avenue, Cleveland, Ohio.

Smith, Frank D......May 15, 1917
Agent, Iroquois Natural Gas Company, Springville, New York.

Smith, H. L......May 16, 1916
Auditor, Carnegie Natural Gas Company, 922 Carnegie Building, Pittsburgh, Pennsylvania.

Smith, H. L......May 16, 1916
District Foreman, Equitable Gas Company, 147 East Fifth Avenue, Homestead, Pennsylvania.

Smith, Frank N......May 18, 1915
Pattern Superintendent, S. R. Dresser Manufacturing Company, 170 Davis Street, Bradford, Pennsylvania.

Smith, W. T......May 16, 1916
Foreman, Hope Natural Gas Company, 304 Clarksburg Street, Mannington, West Virginia.

Snider, C. B......May 15, 1917
Superintendent, Cahokia Gas & Oil Company, 252 North Main Street, Edwardsville, Illinois.

Snoke, Alpheus......May 18, 1915
Field Superintendent, The Logan Natural Gas & Fuel Company, 900 Mechanic Street, Utica, Ohio.

Snyder, H. L......May 21, 1912
Manager, Gas Department, The Owens Bottle Machine Company, Room 503 Goff Building, Clarksburg, West Virginia.

Snyder, W. H......May 22, 1918
Oil and Gas Producer, W. H. Snyder, 224 E. E. Avenue (East End), Beaver, Pennsylvania.

Soper, R. G......May 16, 1911
Secretary, The Dallas Gas Company, 2016 Jackson Street, Dallas, Texas.

South, W. H......May 18, 1915
Secretary, Treasurer, General Manager, Randall Gas Company, P. O. Box 554, Morgantown, West Virginia.

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Southwick, E. F......May 15, 1917
Credit Clerk, East Ohio Gas Company, 7021 Quimby Avenue, Cleveland, Ohio.

Spain, W. H......May 16, 1911
District Representative, Oil Well Supply Company, 215 Water Street, Pittsburgh, Pennsylvania.

Spencer, C. H......May 15, 1917
Shop Superintendent, Calgary Gas Company, Limited, 215 Sixth Avenue, West, Calgary, Alberta, Canada.

Spicer, B. F......May 16, 1916
Agent, Logan Natural Gas & Fuel Company, Bucyrus, Ohio.

Sprague, H. H......May 17, 1910
President, Sprague Meter Company, 205 Water Street, Bridgeport, Connecticut.

Sprenkle, W. A......May 16, 1916
Secretary-Treasurer, Natural Gas Company of West Virginia, 323 Fourth Avenue, Pittsburgh, Pennsylvania.

Stafford, G. M......May 15, 1917
Foreman, Pennsylvania Gas Company, 202 East Washington Street, Corry, Pennsylvania.

Staigers, Charles M......May 22, 1918
Lease Agent, Lemon G. Neely, 12 French Avenue, Winchester, Kentucky.

Staniek, A. E......May 16, 1916
Chief Clerk Contracting Department, Philadelphia Company, 435 Sixth Street, Pittsburgh, Pennsylvania.

Staub, E. J......
Canadian Western Natural Gas, Light, Heat and Power Company, 215 Sixth Avenue, West Calgary, Alberta, Canada.

Stearns, G. A......May 15, 1917
Sawyer-Stearns-Streeter Drilling Corporation, 401 Iroquois Building, Buffalo, New York.

Steenbergen, C. L......May 19, 1914
Manager, Paris Gas & Electric Company, Paris, Kentucky.

Steere, F. W......May 15, 1917
President, Steere Engineering Company, Woodward & Horton Avenues, Detroit, Michigan.

Stein, F. V......May 16, 1916
Foreman, United Natural Gas Company, 570 Arch Street, Meadville, Pennsylvania.

Sternburg, F. M......May 19, 1914
Field Foreman, Iroquois Natural Gas Company, Evans Street, Hamburg, New York.

Stephanus, E. M......May 15, 1917
Salesman, Broderick & Bascom Rope Company, 805 North Main Street, St. Louis, Missouri.

Stephens, T. H......May 16, 1916
Agent, The Manufacturers' Light & Heat Company, East Liverpool, Ohio.

Sterrett, Louis E......May 16, 1916
Manager, Smethport Gas Company, Smethport, Pennsylvania.

Stewart, S. B......May 17, 1910
General Contracting Agent, Philadelphia, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

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Stewart, William.....May 16, 1916
General Foreman, Allegheny Heating Company, 603 Burd Street, North Side, Pittsburgh, Pennsylvania.

Stitt, John C.....May 16, 1916
Field Foreman, Carnegie Natural Gas Company, West Union, West Virginia.

Stokes, D. J., Jr.....May 16, 1916
Field Superintendent, The Natural Gas Company of West Virginia, Harveys, Greene County, Pennsylvania.

Stone, Frederick W.....May 21, 1907
Manager, Ashtabula Gas Company, 6 Progress Street, Ashtabula, Ohio.

Stotler, R. M.....May 19, 1908
District Manager, Pittsburgh Meter Company, 605 Victor Building, Kansas City, Missouri.

Streiber, Theo.....May 20, 1913
Superintendent of Contracts, Sun Vapor & Gas Street Light Company, 1000 South Market Street, Canton, Ohio.

Stout, Wilber.....May 16, 1916
Assistant Geologist, Geological Survey of Ohio, 291 East Northwood Avenue, Columbus, Ohio.

Strickler, James P.....May 21, 1907
Superintendent Distribution, Columbus Gas & Fuel Company, 135 North Front Street, Columbus, Ohio.

Stringer, Harrison.....May 18, 1915
Superintendent, Dominion Natural Gas Company, Simcoe, Ontario, Canada.

Strong, Murray.....May 16, 1916
Foreman, Arkansas Natural Gas Company, Arkadelphia, Arkansas.

Stroup, Lloyd.....May 15, 1917
Field Foreman, Dominion Gas Company, Merlin, Ontario, Canada.

Stroup, John.....May 15, 1917
Foreman, Glenwood Natural Gas Company, Limited, Port Alma, Ontario, Canada.

Stuart, George J.....May 16, 1911
Chief Engineer, Pittsburgh Valve Foundry & Construction Company, 26th Street and A. V. R. R., Pittsburgh, Pennsylvania.

Sullivan, J. R.....May 20, 1913
Superintendent, Street Department, The East Ohio Gas Company, East 62nd, North of St. Clair, Cleveland, Ohio.

Sullivans, P. D.....May 16, 1916
Foreman, Iroquois Natural Gas Company, 37 Church Street, Buffalo, New York.

Sullivan, T. O.....May 16, 1911
General Manager, Hope Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Sutton, A. I.....May 16, 1916
Foreman, Hope Natural Gas Company, R. F. D., St. Marys, West Virginia.

Swan, George J.....May 18, 1909
Superintendent, Consumers Light, Heat & Power Company, 214 East First Street, Topeka, Kansas.

Swartz, J. K.....May 16, 1916
Foreman, Hope Natural Gas Company, Salem, West Virginia.

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Sweetman, W. D.....May 16, 1911
Superintendent, Peoples Gas Light & Coke Company, 1241 West Division Street, Chicago, Illinois.

Sykes, J. D.....May 16, 1911
Superintendent, The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Swendeman, Joseph E.....May 15, 1917
Special Representative, American Steam Gauge & Valve Manufacturing Company, 256 West Newton Street, Boston, Massachusetts.

Tanner, J. Roy.....May 16, 1911
General Manager, Pittsburgh Valve, Foundry & Construction Company, P. O. Box 1016, Pittsburgh, Pennsylvania.

Taylor, E. R.....May 18, 1915
Secretary and Treasurer, Fayette Light & Fuel Company, Fayette, Alabama.

Taylor, George.....May 15, 1917
Foreman, Alden-Batavia Natural Gas Company, 25 Brooklyn Avenue, Batavia, New York.

Taylor, George E.....May 15, 1917
Assistant Engineer, Public Service Commission of West Virginia, State House, Charleston, West Virginia.

Taylor, J. W.....May 16, 1916
Foreman, Reserve Gas Company, 226 Bennett Street, Weston, West Virginia.

Teague, O. C.....May 21, 1912
President, The Utica Gas, Oil & Mining Company, Utica, Ohio.

Teegerstrum, Victor S.....May 15, 1917
Superintendent, Monroe Gas Company, Monroe, Louisiana.

Terry, L. B.....May 16, 1911
Agent, The East Ohio Gas Company, 19-21 North High Street, Akron, Ohio.

Texter, L. J.....May 15, 1917
Foreman, Alden-Batavia Natural Gas Company, Pavilion, New York.

Thatcher, J. H.....May 21, 1912
Manager, Mansfield Gas Company, Jefferson Street, Mansfield, Ohio.

Thiel, Martin A.....May 18, 1915
Chief Engineer, Gas Engine Department, The C. & G. Cooper Company, 118 East Lamartine Street, Mt. Vernon, Ohio.

Thomas, Edgar.....May 20, 1913
Gas Engineer, Hope Engineering Company, 126 Farmers Bank Building, Pittsburgh, Pennsylvania.

Thomas, Fred H.....May 16, 1916
Sales Engineer, The C. & G. Cooper Company, Mt. Vernon, Ohio.

Thomas, Howard V.....May 16, 1911
Vice President, West Virginia & Maryland Gas Company, 312 Fidelity Building, Buffalo, New York.

Thompson, Paul.....May 17, 1910
Fifth Vice President, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

Thompson, William H.....May 16, 1911
Secretary, Ohio Gas and Oil Association, 812 New First National Bank, Columbus, Ohio.

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Thompson, W. P......May 15, 1917
55 Kennedy Street, Bradford, Pennsylvania.

Tibbens, W. P......May 20, 1913
Shop Foreman, The East Ohio Gas Company, 10611 Garfield Avenue, Cleveland, Ohio.

Tillotson, F. H......May 20, 1913
City Foreman, Pennsylvania Gas Company, 116 Broadhead Avenue, Jamestown, New York.

Tims, H. S......May 18, 1915
Treasurer, The Canadian Western Natural Gas, Light, Heat & Power Company, Limited, 215 Sixth Avenue, West, Calgary, Alberta, Canada.

Tippett, W. H......May 19, 1908
Secretary-Treasurer, Creek County Gas Company, Box 126, Cushing, Oklahoma.

Titzel, J. C......May 16, 1916
General Manager, Glenshaw Gas Company, Glenshaw, Pennsylvania.

Titzel, R. John......May 15, 1917
Gas Engineer, United Gas Electric Engineering Corporation, 2100 First Avenue, Birmingham, Alabama.

Tomb, Frank B......May 18, 1915
President, Kentucky Oil Men's Association, Winchester, Kentucky.

Tomer, Adam......May 16, 1916
Shop Foreman, The Peoples Natural Gas Company, 1919 Forbes Street, Pittsburgh, Pennsylvania.

Tonkin, John B......May 21, 1912
Vice President and General Manager, The Peoples Natural Gas Company, 424 Sixth Avenue, Pittsburgh, Pennsylvania.

Tonkin, John......May 15, 1917
Vice President and General Manager, Central Kentucky Natural Gas Company, Oil City, Pennsylvania.

Tonkin, T. J., Jr......May 15, 1917
Superintendent, Frankfort, Kentucky, Natural Gas Company, 318 Lewis Street, Frankfort, Kentucky.

Tonkin, Wade H......May 16, 1916
Agent, Hope Natural Gas Company, 250 West Tenth Street, Parkersburg, West Virginia.

Topp, A. A......May 15, 1917
Foreman, Central Repair Shop, The Ohio Fuel Supply Company, Mt. Vernon, Ohio.

Torrance, C. E......May 16, 1916
Agent, The Peoples Natural Gas Company, Altoona, Pennsylvania.

Torrance, E. E......May 15, 1917
Foreman, Frost Gas Company, Fredonia, New York.

Torrance, J. M......May 16, 1916
Agent, The Peoples Natural Gas Company, 28 North Walnut Street, Blairsville, Pennsylvania.

Towl, Forrest M......May 21, 1912
President, Southern Pipe Line Company, 26 Broadway, New York, New York.

Tracy, F. B......May 16, 1916
Manager, Muncie Division, Central Indiana Gas Company, 301 East Main Street, Muncie, Indiana.

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Tracy, Frederick D.....May 16, 1911
Purchasing Agent, West Virginia & Maryland Gas Company, 312 Fidelity Building, Buffalo, New York.

Treat, Ellis M.....May 16, 1911
President, The Summerfield Gas Company, 1212 Union Bank Building, Pittsburgh, Pennsylvania.

Trees, J. C.....May 16, 1911
President, Arkansas Natural Gas Company, Benedum-Trees Building, Pittsburgh, Pennsylvania.

Trainer.....

Treleaven, L. G.....May 21, 1907
Receiver, Consumers Light, Heat & Power Company, 200 West Sixth Street, Topeka, Kansas.

Troutman, P. A.....May 16, 1916
Division Superintendent, Carnegie Natural Gas Company, Sherman and Sixth Streets, Waynesburg, Pennsylvania.

Tucker, Calvert C.....May 15, 1917
Engineer, Dominion Natural Gas Company, 842 Marine National Bank Building, Buffalo, New York.

Tucker, Davis H.....May 15, 1917
Engineer, Southern Ontario Gas Company, Limited, R. R. No. 4, Merlin, Ontario, Canada.

Tucker, G. C.....May 16, 1916
Foreman, The East Ohio Gas Company, 1101 Second Street, Massillon, Ohio.

Turner, Lyle.....May 20, 1913
Credits and Collections, The East Ohio Gas Company, East Ohio Gas Building, Cleveland, Ohio.

Tyng, Arthur.....May 15, 1917
Consulting Engineer, Iroquois Natural Gas Company, 709 Iroquois Building, Buffalo, New York.

Underwood, R. L.....May 16, 1916
Manager and Assistant Secretary and Treasurer, Herring Oil & Gas Company, North Side Ellis, Groesbeck, Texas.

Vallely, J. F.....May 15, 1917
Agent, Cattaraugus, New York, Iroquois Natural Gas Company, Cattaraugus, New York.

Vance, George B.....May 16, 1916
Superintendent, Drilling Department, Randall Gas Company, Mapletown, Pennsylvania.

VanSickel, Walter S.....May 17, 1910
General Manager, Southwestern General Gas Company, 301 Garrison Avenue, Fort Smith, Arkansas.

Voelkle, L. P.....May 18, 1915
Chief Clerk, The East Ohio Gas Company, Youngstown, Ohio.

Walker, W. O.....May 16, 1916
Secretary-Treasurer, Frankfort (Kentucky) Natural Gas Company, 206 Seneca Street, Oil City, Pennsylvania.

Wallace, H. A.....May 18, 1915
General Manager, United Fuel Gas Company, 919 Quarrier Street, Charleston, West Virginia.

Wallace, J. B.....May 18, 1915
Superintendent, Logan Natural Gas & Fuel Company, 134 College Avenue, Ashland, Ohio.

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Wallace, Robert J.....May 22, 1918
Superintendent Contracts, Empire Companies, Empire Building, Bartlesville, Oklahoma.

Walsh, D. C.....May 20, 1913
General Foreman, The East Ohio Gas Company, 400 Tuscarawas Avenue, Canton, Ohio.

Walsh, John H.....May 20, 1913
Superintendent, Iroquois Natural Gas Company, Church and Franklin Streets, Buffalo, New York.

Walsh, Maurice W.....February 27, 1906
Superintendent, Distribution and Construction, The Louisville Gas & Electric Company, 311 West Chestnut Street, Louisville, Kentucky.

Walters, C. K.....May 16, 1916
District Foreman, Equitable Gas Company, Chestnut and Lydia Streets, Carnegie, Pennsylvania.

Walton, J. D.....May 18, 1915
Iroquois Natural Gas Company, Buffalo, New York.

Wanamaker, George B.....May 20, 1913
237 South Volencia Street, Wichita, Kansas.

Ward, C. F.....May 16, 1916
Foreman, Construction Department, Ohio Fuel Supply Company, Homer, Ohio.

Ward, R. W.....May 20, 1913
Foreman, United Natural Gas Company, Oil City, Pennsylvania.

Wardell, Charles W.....May 20, 1913
Welsbach Company, Gloucester, New Jersey.

Waring, C. H.....May 21, 1912
Superintendent, The Wyandotte County Gas Company, 600 Minnesota Avenue, Kansas City, Kansas.

Watson, W. E.....May 21, 1912
Assistant General Manager of Sales, The Youngstown Sheet & Tube Company, Youngstown, Ohio.

Watts, Albert E.....May 21, 1912
Oil and Gas Producer, 1401 South Carson Street, Tulsa, Oklahoma.

Watts, Harry P.....May 15, 1917
Field Clerk, Peoples Natural Gas Company, Brave, Greene County, Pennsylvania.

Way, William B.....May 18, 1909
District Manager, The Ludlow Valve Manufacturing Company, 2008 First National Bank Building, Pittsburgh, Pennsylvania.

Wearing, George E.....May 16, 1916
General Manager, Tri-County Natural Gas Company, Midland Gas Company, Consumers Gas & Heat Company, Second National Bank Building, Clarion, Pennsylvania.

Weaver, S. D.....May 16, 1916
Agent, Manufacturers' Gas Company, Bradford, Pennsylvania.

Webber, Daniel S.....May 20, 1913
Superintendent Lease Department, The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio.

Wege, Henry P.....May 15, 1917
Oil Well, Refinery & Mill Supplies, Henry P. Wege, 24 Horn Avenue, Oil City, Pennsylvania.

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Weir, James B.....May 18, 1915
Secretary-Treasurer, Falling Rock Cannel Coal Company, National City Bank Building, Charleston, West Virginia.

Welch, William M.....February 27, 1906
Manager, Tidal Gasoline Company, P. O. Box 1733, Tulsa, Oklahoma.

Welker, George E.....May 20, 1913
Chief Engineer, Iroquois Natural Gas Company, 311 Iroquois Building, Buffalo, New York.

Wellman, A. Miner.....May 15, 1917
President, Tri-County Natural Gas Company, Caledonia, New York.

Wentzel, Howard W.....May 16, 1916
Special Agent, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Werner, E. M.....May 20, 1913
Superintendent, Lease Department, The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

West, Olandus.....May 22, 1918
President, Vesper Oil & Gas Company, Empire Building, Clarksburg, West Virginia.

Westcott, Henry P.....May 21, 1907
Engineer, Metric Metal Works, 1004 West 26th Street, Erie, Pennsylvania.

Weymouth, Thomas R.....May 16, 1911
Chief Engineer, United Natural Gas Company, 308 Seneca, Oil City, Pennsylvania.

Wheeler, Edward M.....May 21, 1912
Treasurer, West Virginia Central Gas Company, 312 Fidelity Building, Buffalo, New York.

Whitcomb, E. C.....May 19, 1914
Chief Engineer, The Logan Natural Gas & Fuel Company, Elyria, Ohio.

Whitcomb, E. P.....May 18, 1909
President and General Manager, The Union Natural Gas Corporation, 1607 Union Bank Building, Pittsburgh, Pennsylvania.

White, David.....May 16, 1916
Foreman, Hope Natural Gas Company, Smithville, West Virginia.

White, T. J.....May 16, 1916
Field Foreman, Carnegie Natural Gas Company, Hundred, West Virginia.

Whitehead, L. K.....June 12, 1906
Superintendent, Gas Department, Southwestern Gas & Electric Company, 122 East Broad Street, Texarkana, Texas.

Whiteley, Wm. H.....May 22, 1918
With Wm. G. Cummings, 803 Union Bank Building, Pittsburgh, Pennsylvania.

Wickham, T. F.....May 20, 1913
Second Vice President, Union Gas & Electric Company, Fourth and Plum Streets, Cincinnati, Ohio.

Wickett, Gordon D.....May 18, 1915
Vice President and Treasurer, Windsor Gas Company, Limited, 33 Chatham Street, West, Windsor, Ontario, Canada.

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Wiggins, J. H.....May 15, 1917
Engineer, Indian Territory, Illinois Oil & Gas Company, Box 1042, Bartlesville, Oklahoma.

Wikoff, J. B.....May 16, 1911
The Ohio Fuel Supply Company, 2107 Farmers Bank Building, Pittsburgh, Pennsylvania.

Williams, D. W.....May 15, 1917
Geologist, Dominion Natural Gas Company, 842 Marine National Bank Building, Buffalo, New York.

Williams, John B.....May 16, 1911
Secretary-Treasurer, The Sarnia Gas & Electric Company, Limited, 227 North Front Street, Sarnia, Ontario, Canada.

Williams, John H.....May 16, 1916
Superintendent, Hope Natural Gas Company, Despard Street, Clarksburg, West Virginia.

Williams, R. J.....May 20, 1913
Chief Engineer, United Natural Gas Company, R. D. No. 2, Kane, Pennsylvania.

Williams, W. A.....May 20, 1913
Assistant to General Manager, Empire Gas & Fuel Company, Bartlesville, Oklahoma.

Williams, W. A.....May 15, 1917
Superintendent, West Virginia Central Gas Company, Weston, West Virginia.

Williamson, E. W.....May 16, 1916
Division Superintendent, Hope Natural Gas Company, 1726 Saint Marys Avenue, Parkersburg, West Virginia.

Willoughby, Horace.....May 18, 1909
Assistant Manager, Scioto Valley Supply Company, Third and Long Streets, Columbus, Ohio.

Wilsey, J. H.....May 15, 1917
Assistant Superintendent, Ashtabula Gas Company, 6 Progress Street, Ashtabula, Ohio.

Wilson, A. M.....May 16, 1911
Room 330, Robinson Building, Tulsa, Oklahoma.

Wilson, Henry M.....May 16, 1911
District Agent, Pittsburgh Valve, Foundry & Construction Company, 1250 Rockefeller Building, Cleveland, Ohio.

Wilson, J. C.....May 21, 1912
Engineer, Cutler Hammer Manufacturing Company, Twelfth Street and Saint Paul Avenue, Milwaukee, Wisconsin.

Wilson, W. E.....May 15, 1917
Agent, Pennsylvania Gas Company, 100 West Main Street, Corry, Pennsylvania.

Winans, W. B. S.....
Assistant General Auditor, Henry L. Doherty & Co., 60 Wall Street, New York, New York.

Wingard, Guy H.....May 16, 1916
Foreman, Manufacturers' Gas Company, Marlin Building, Brookville, Pennsylvania.

Wittkorski, F. D.....May 15, 1917
Chief Inspector, Union Natural Gas Company of Canada, Limited, 95 Wellington Street, Chatham, Ontario, Canada.

Wittmer, George, Jr.....May 16, 1911
Treasurer, American Natural Gas Company, 1511 Park Building, Pittsburgh, Pennsylvania.

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Wittmer, Henry.....May 18, 1909
Secretary, American Natural Gas Company, 407 Park Building, Pittsburgh, Pennsylvania.

Wittmer, Thomas.....May 17, 1910
Division Superintendent, American Natural Gas Company, 1013 Sheridan Avenue, Pittsburgh, Pennsylvania.

Wolfe, W. W.....May 19, 1914
Assistant Secretary, United Fuel Gas Company, 1590 Quarrier Street, Charleston, West Virginia.

Wonderley, W. V.....May 16, 1916
Superintendent, Compression Plants, Logan Natural Gas & Fuel Company, 34 Ruggery Building, Columbus, Ohio.

Wood, L. L.....May 15, 1917
Foreman, Pennsylvania Gas Company, 201 East 5th Avenue, Warren, Pennsylvania.

Wood, W. L., Jr.....May 17, 1910
General Manager, Southwestern Gas & Electric Company, 116 East Broad Street, Texarkana, Arkansas.

Woodworth, R. B.....May 16, 1911
Advertising Manager, Carnegie Steel Company, Carnegie Building, Pittsburgh, Pennsylvania.

Wrenn, J. W.....May 20, 1913
Manager, Economic Gas Company, 345 South Hill Street, Los Angeles, California.

Wyer, Samuel S.....May 21, 1912
Consulting Engineer, Hartman Building, Columbus, Ohio.

Yorke, Patrick.....May 16, 1911
Manager, Yorke Derrick Company, 199 North Main Street, Washington, Pennsylvania.

Young, James M. H.....February 27, 1906
Manager, City Gas Company, 215 Dundar Street, London, Ontario, Canada.

Young, W. H.....May 16, 1916
Secretary Island Oil and Transport Company, 62 Cedar Street, New York, New York.

Young, William T.....May 20, 1913
Mechanical Engineer, United Natural Gas Company, 513 North Street, Oil City, Pennsylvania.

Zeller, S. E.....May 20, 1913
General Foreman, The East Ohio Gas Company, 322 Wooster Avenue, Canal Dover, Ohio.

Zimmerman, C. W.....May 16, 1916
Chief Clerk, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.

Zitzewitz, W. R.....May 19, 1908
Secretary-Treasurer, National Machine Works, Sheffield and North Avenues, Chicago, Illinois.

SUMMARY OF CLASSES OF MEMBERSHIP.

Honorary Members	8
Active Members	1,216
Total	1,224

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GEOGRAPHICAL DISTRIBUTION

Alabama

Birmingham	R. John Titzel
Fayette	E. R. Taylor

Arkansas

Arkadelphia	Murray Strong
Fort Smith	Walter S. VanSickle
Hope	M. F. Secrest
Little Rock	W. F. Booth
	E. J. Cole
	B. J. Gifford
	C. W. Kramer
	John Russell Munce
	W. T. Roberts
Malvern	A. J. Gilbert
Pine Bluff	M. D. Randolph
Prescott	James Barry

California

Bakersfield	J. F. McMahon
Los Angeles	Charles D. Bell
	Walter B. Cline
	Alexander B. Macbeth
	Nathan L. Morse
	F. Shafer
	J. W. Wrenn
San Francisco	W. R. Hamilton
	John Martin
Santa Maria	L. F. Chandler
Taft	Frederick F. Doyle
	William Moeller, Jr.

Connecticut

Bridgeport	W. P. Hutchinson
	H. H. Sprague
Waterbury	John Douglass Alden

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District of Columbia

Washington	R. S. McBride

Illinois

Chicago	W. A. Baehr
	O. M. Carter
	Henry M. Dawes
	William H. Graffis
	W. S. Grear
	W. H. Hodge
	B. J. Kellum
	John W. Lansley
	Joseph C. Markley
	Edward G. Pratt
	Milt. Saul
	W. D. Sweetman
	W. R. Zitzewitz
Decatur	Fred B. Mueller
Edwardsville	C. B. Snider
Jacksonville	John D. Robertson

Indiana

Anderson	J. C. Groble
Middletown	C. R. Heath
Muncie	A. T. Bartow
	E. L. Haymond
	Harry R. Maxon
	John H. Maxon
	F. B. Tracy
Vincennes	A. M. Ewing

Kansas

Chanute	Hugh T. Jones
Coffeyville	L. E. Robinson
	W. H. Shepard
Independence	H. I. Cowham
	Con Cumings
	C. A. Gibson
	Victor A. Hays
	G. F. Mahan
	J. E. Remler
Iola	F. J. Horton
Kansas City	Wm. Hunter McKenzie
	C. H. Waring

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Kansas — Concluded.

Lawrence	E. H. S. Bailey
	Caryl J. Dodds
	Erasmus Haworth
Topeka	George J. Swan
	L. G. Treleaven
Wichita	R. A. Crawford
	Walter S. Hoyte
	E. S. Miller
	L. O. Ripley
	G. N. Rumbaugh

Kentucky

Covington	D. C. Shaffer
Frankfort	T. J. Tonkin, Jr.
Irvine	James C. Heydrick
Louisville	Charles DeWeese
	Donald McDonald
	J. R. Ramage
	Maurice W. Walsh
Maysville	Horace J. Cochran
Paris	C. L. Steenbergen
Winchester	William B. Davis
	Charles E. Hill
	Calvin T. Moore
	Charles M. Staigers
	Frank B. Tomb

Louisiana

Houma	W. H. Sedberry
Mooringsport	G. S. Boyd
Monroe	V. S. Teegerstronn
Shreveport	J. P. Bahan
	M. B. Carmody
	Austin G. Curtis
	C. A. Dally, Jr.
	T. J. Heard
	G. R. Jordan
	T. F. O'Brian
	J. F. Palmer
	Wm. M. Palmer
	George B. Sipe
Vivian	W. A. Long

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Maryland

Baltimore	Frank Cavenagh
	Charles M. Cohn
	Alten S. Miller
Cumberland	J. C. Cunningham

Massachusetts

Boston	Godfrey L. Cabot
	Henry B. Nickerson
	Joseph E. Swendeman
Foxboro	J. R. Shattuck

Michigan

Detroit	Warren S. Blauvelt
	James T. Lynn
	Henry D. Schall
	F. W. Steere
Port Huron	B. J. Crahan

Missouri

Kansas City	E. L. Brundrett
	Alfred Hurlburt
	T. B. Jarvies
	Hoyle Jones
	Eugene Metz
	Frank F. Schauer
	John Milton Scott
	R. M. Stotler
	M. M. Sweetman
St. Louis	Daniel M. Armstead
	William K. Hughes
	E. M. Stephanus
Webb City	Charles O'Neill

New Jersey

Gloucester City	Alphonso Mason
	Sidney Mason
	Charles W. Wardell

New York

Albany	Charles F. Leonard
Alden	W. H. Bass
Angola	J. D. Cleary
Attica	Charles W. Slack
Batavia	W. B. Kellogg
	G. D. Lynch
	George Taylor

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New York — Continued.

Buffalo	Thomas Armstrong
	Lucius S. Bigelow
	T. P. Blackall
	John T. Blewett
	C. E. Borchard
	Leigh A. Brown
	C. L. Butler
	W. C. Carey
	Joseph P. Conners
	Frank Cosan
	W. M. Cusack
	H. R. Davis
	Dorr T. Denton
	Bernard F. Dowd
	J. T. Flanigan
	H. A. Forman
	A. W. Gavin
	Homer R. Gray
	Henry C. Hall
	H. Harney, Jr.
	William Hastings
	B. L. Hawkins
	Ralph Hockstetter
	H. R. Hoffman
	Perry A. Little
	Guy H. Loveridge
	Frank M. Lowrey
	Carl H. Lutz
	John T. Mahoney
	G. E. McCann
	Edward P. McCormick
	J. E. McKimmie
	D. P. McMahon
	John McMahon
	Edwin Allen McPherson
	W. Lorne Munro
	Henry S. Norris
	Bert C. Oliphant
	F. H. Oliphant
	Ira B. Reed
	J. M. Reiley
	J. A. Richie
	E. M. Ryan
	C. M. Sloan

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New York — Continued.

Buffalo	W. M. Sloan
	G. A. Stearns
	P. D. Sullivans
	Howard V. Thomas
	F. D. Tracy
	Calvert C. Tucker
	Arthur Tyng
	John H. Walsh
	George E. Welker
	Edward M. Wheeler
	D. W. Williams
Caledonia	A. G. Baker
	M. A. Brady
	A. Miner Wellman
Cattaraugus	J. T. Vallely
Clarence	J. H. Fisher
Collins Center	Charles L. Reiser
Corning	George S. Goff
	W. M. Gurnsey
Dunkirk	F. Fair
	G. E. Falk
	M. E. Hammon
East Aurora	E. K. Fuller
Fredonia	E. E. Torrance
Gardenville	S. F. Brandel
Gowanda	M. McIntyre
Hamburg	D. M. Dittman
	John Hastings
	Frank Johnson
	F. M. Sternburg
Holcomb	L. L. Case
Honeoye Falls	F. L. Kellogg
Hornell	J. B. Bradley
Jamestown	James Cratty
	E. M. Schlaudecker
	F. H. Tillotson
Lancaster	P. P. Adolf
LeRoy	J. S. L. Purdy
New York	H. C. Abell
	William E. Barrett
	A. C. Bedford
	J. A. Blair
	R. W. Brink
	L. G. Coleman

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New York — Concluded.

New York City	J. W. R. Crawford
	A. J. Diescher
	Henry L. Doherty
	Alfred E. Forstall
	Robert G. Griswold
	Alexander C. Humphreys
	George H. Jones
	W. J. Judge
	H. K. Landis
	Alanson P. Lathrop
	Henry O. Loebell
	Emerson McMillin
	Worden Pope
	C. A. H. de Saulles
	Marvin Shiebler
	Forest M. Towl
	W. B. S. Winans
Olean	F. W. Herron
	H. L. Jacoby
Pavilion	W. H. Lobaugh
	L. J. Texter
Rochester	R. M. Searle
Salamanca	J. L. Ryan
Springville	Frank D. Smith
Wellsville	Harry Bradley

Ohio

Akron	James P. Laughlin
	Franklin C. Murray
	James Scoville
	L. B. Terry
Alliance	W. J. Rose
Ashland	W. H. Adams
	J. B. Wallace
Ashtabula	A. W. Herring
	F. W. Stone
	J. H. Willsey
Barberton	S. C. McKnight
	E. L. Saeger
Berea	M. K. Clover
	P. J. Cookham
Bucyrus	W. S. Frey
	B. F. Spicer
Cadiz	Carl D. Mead

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Ohio — Continued.

Cambridge	A. C. Sarchet
Canal Dover	S. E. Zeller
Canton	E. O. Deal
	D. W. Hannon
	E. T. Jones
	Thomas M. Lee
	John J. McMahon
	W. J. Morgan
	Theo. Schreiber
	D. C. Walsh
Chillicothe	Walter A. Ashley
Cincinnati	C. J. Bauer
	W. Y. Cartwright
	C. D. Corbus
	John M. Cronin
	C. W. DeForest
	Joseph P. Delaney
	Frank Espach
	A. F. Flocken
	W. W. Freeman
	Judson Harmon
	F. R. Healey
	H. J. Hoover
	Charles Krause
	J. H. Lakamp
	C. R. McKay
	William A. Miller
	B. F. Newhouse
	C. D. Reichel
	E. R. Rothert
	R. C. Rowan
	Amy Sherlock
	George H. Smies
	T. F. Wickham
Cleveland	C. B. Apple
	M. F. Barrett
	C. L. Bryant
	L. G. Bub
	Harry C. Culp
	Martin B. Daly
	F. T. Dooling
	T. C. Donahue
	C. W. Downing
	Karl Emmerling

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Ohio — Continued.

Cleveland	E. C. Fox
	R. W. Gallagher
	C. W. Gardner
	A. L. Gassett
	C. B. Gates
	Oscar C. Gericke
	S. M. Gill
	E. Given
	J. F. Gray
	W. G. Hagen
	J. G. Hanks
	George S. Harris
	W. C. Higgins
	W. H. Holtz
	George H. Horseley
	Franklin H. Hurd
	Frank R. Hutchinson
	William H. Knight
	W. R. Knowles
	James Martin
	H. E. McCandless
	M. J. Murray
	Charles L. Norton
	T. M. O'Connor
	George L. Olney
	Peter Ostrye
	D. V. Peden
	George W. Plagenz
	Ambrose J. Quinlan
	A. B. Rae
	Hoyt V. Shulters
	Edward Smith
	E. F. Southwick
	J. R. Sullivan
	W. P. Tibbens
	Lyle Turner
	E. M. Werner
	Henry M. Wilson
Columbus	P. A. Alberty
	S. S. Allen
	H. T. Ashton
	P. M. Biddison
	J. A. Bownocker
	William J. Broder

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Ohio — Continued.

Columbus	W. Re Brown
	R. B. Burr
	Clarence E. Carter
	E. F. Clagett
	M. A. Corbett
	Henry Coyle
	F. H. Crawford
	Frederick W. Crawford
	J. D. Creveling
	C. F. Critchfield
	J. F. Curry
	Beman G. Dawes
	D. Friedenberg
	John M. Garard
	O. C. Hagen
	H. H. Hall
	John I. Henderson
	G. E. Howard
	C. H. Jay
	T. J. Jones
	T. H. Kerr
	Oscar G. Krebs
	Kay C. Krick
	W. H. Lane
	Alan Leamy
	Preston W. Lupher
	M. E. Lytle
	J. W. McCord
	M. A. Newton
	Nelson A. Newton
	J. F. Olmstead
	C. J. Palm
	C. C. Phillips
	Henry T. Phillips
	R. M. Porterfield
	E. C. Ramsey
	J. D. Renick
	Elmer F. Schmidt
	G. C. Scott
	George S. Shinnick
	Wilber Stout
	James P. Strickler
	J. D. Sykes
	W. H. Thompson

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Ohio — Continued.

Columbus	Daniel S. Webber
	Horace Willoughby
	W. V. Wonderley
	Samuel S. Wyer
Coshocton	Ernest B. Smith
Cuyahoga Falls	W. J. Cain
	Phil Lewis
Dayton	E. D. Batdorf
	W. E. Franz
	Robert A. Frevert
	I. L. Lehman
	George Light
	W. W. Price
Delaware	Thomas Clive Jones
	John F. Shoub
Dennison	J. R. Matson
East Liverpool	T. H. Stevens
Elyria	W. M. Adams
	H. H. Harrington
	E. C. Whitcomb
Findlay	G. P. Schatzel
	John Seibel
Fostoria	E. L. Lepper
Fremont	R. L. Hottinger
	A. H. Lewis
	Elmer Loveland
Galion	F. A. Fralic
Geneva	William E. Donnelly
Greenville	D. S. Robertson
Homer	B. F. Blake
	Hugh T. Boyd
	C. F. Ward
Imperial	James Henderson
Ironton	Ira S. Burford
Jefferson	Ross Riggs
Jewett	F. N. Donaldson
Kent	O. M. Baldwin
Lancaster	William Blum
	J. C. Dallow
	John J. Klise
	James Murtaugh
	W. A. Pannabecker
Leetonia	Robert W. Cushing
Malta	Henry C. Hopp

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Ohio — Continued.

Mansfield	B. R. Bay
	A. L. Brown
	C. E. Carter
	S. M. Douglass
	H. F. Finley
	Harry G. Leight
	J. H. Thatcher
Marietta	William Horn
	F. H. Leidecker
	P. J. Quinlan
	F. L. Reed
Marion	M. A. Mickley
Massillon	J. A. Foster
	G. C. Tucker
Miamisburg	W. J. Doebele
Millersburg	C. F. Cluley
Mt. Vernon	E. Brunner
	R. S. Lord
	Jesse Rearick
	Martin A. Thiel
	Fred H. Thomas
	A. A. Topp
Newark	R. E. Boothe
	L. F. Carl
New Lexington	Ira I. Hazlett
	Charles Seibert
New Philadelphia	W. H. Dimick
Niles	Charles Kiesel
Norwalk	W. G. Kohl
Pavonia	H. R. Hyatt
	John A. Miller
Piqua	F. B. Reeser
Ravenna	Edward P. Martin
	Edward Shriver
Saint Marys	Lemon G. Neely
Salem	H. A. Gager
	J. A. Harwood
	D. B. McCune
	J. H. Montgomery
Springfield	E. D. Abbott
Steubenville	H. W. Bishop, Jr.
	O. J. Daugherty
Sugar Grove	C. M. Hawk
	H. T. Holland

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Ohio — Continued.

Tiffin	Homer R. Rogers
Toledo	James H. Barr
	R. J. Burkwalter
	Frank Collins
	F. G. Giegel
	Albert H. Gindele
	W. C. Longenecker
	Charles W. Mascho
	John B. McMahon
	James W. McMahon
	Charles S. Northup
	W. H. Scott
Uhrichsville	J. D. Walton
Utica	Alpheus Snoke
	O. C. Teague
Warren	G. C. Lohr
	L. M. McCormick
Wellston	Chas. H. Garard
West Park	Charles Craft
	J. W. Irwin
	L. C. Klein
	B. Slogle
Westerville	O. L. Bruckner
Wooster	R. A. Brook
	James C. Burtner
	F. D. Dougherty
	Fenwick Ewing
	W. H. Frees
	R. L. Heaton
	Charles L. Helm
	A. G. Hottle
	Park Hovis
	H. D. Hull
	William Leamon
	J. L. Maloney
	C. A. McClintock
	M. A. McHenry
	Ira L. Neely
	H. B. Odenkirk
	Adrian T. Parr
	Clifton W. Sears
	G. E. Shoup
	George B. Wanamaker
Xenia	R. W. Irwin

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Ohio — Concluded.	
Youngstown	John Baxter
	Harry P. Fish
	C. E. Gallagher
	D. G. Geary
	William E. Manning
	L. P. Voelkle
	W. E. Watson
Zanesville	H. H. Dreibelbis
Oklahoma	
Ardmore	H. B. Goodrich
Bartlesville	H. O. Ballard
	W. C. Baxter
	L. B. Benson
	C. E. Brock
	Charles L. Bullock
	George H. Burress
	Everett Carpenter
	Frank F. Finney
	Francis P. Fisher
	James P. Fisher
	H. V. Foster
	John D. Hackstaff
	Richard C. Hackstaff
	T. A. Hall
	Roy S. Hazeltine
	Jesse W. Hines
	J. J. Larkin
	S. A. McCune
	S. E. Murphy
	R. C. Russum
	Fred B. Seem
	R. J. Wallace
	J. H. Wiggins
	W. A. Williams
Chandler	W. W. Bruce
Cushing	W. H. Tippett
Drumright	J. F. Allen
Guthrie	W. J. Dibbens
Muskogee	J. F. Owens
Norman	Jerome B. Burnett
Oklahoma City	Charles N. Gould
Okmulgee	J. S. Clark
Pawhuska	H. H. Brenner

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Oklahoma — Concluded.

Poteau	Howard Cassell
Sapulpa	C. C. Cantrell
Tulsa	Joseph Ardizzone
	W. H. Bagley
	Eugene Braden
	Glenn T. Braden
	Floyd J. Bradford
	Earl A. Clark
	John M. Clover
	S. C. Clover
	B. M. Gessel
	H. N. Greis
	Harry Heasley
	A. G. Heggem
	J. P. Herr
	A. W. Leonard
	Robert J. Lindsay
	W. R. Lindsay
	M. P. Lyon
	L. R. McCarthy
	S. F. McCluney
	John L. O'Donnell
	Fred J. Ossenbeck
	Jay C. Painter
	E. R. Perry
	E. W. Sinclair
	A. E. Watts
	William M. Welch
	A. M. Wilson

Pennsylvania

Altoona	John Hilty
	C. E. Torrance
Ardmore	I. N. Knapp
Aspinwall	H. E. LeFevre
	Charles A. Ralph
Beaver	W. H. Snyder
Belle Vernon	E. P. Nole
Blairsville	Frank Heazlett
	J. M. Torrance
Braddock	L. R. Dingman
Bradford	T. N. Barnsdall
	Elmer C. Beatty
	P. M. Berwald

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Pennsylvania — Continued.

Bradford	George W. Bovaird
	C. L. Clark
	A. A. Crawford
	Z. B. Custer
	Carl K. Dresser
	Todd Evans
	T. E. Hanley
	L. E. Mallory
	Fred A. Miller
	A. J. Paris, Jr.
	R. S. Pringle
	Frank N. Smith
	W. P. Thompson
	S. D. Weaver
Brave	F. D. Freeland
	William T. Kent
	J. L. Ridgeway
	Harry P. Watts
Brookville	R. B. Barnes
	F. C. Deemer
	C. F. Kimmell
	Guy Wingard
Brownsville	Thomas D. Hann
Burgettstown	D. W. Inghram
Butler	R. A. Beech
	W. H. Larkin
	J. F. Lyon
Canonsburg	John Foley
	S. D. McCloy
Carnegie	C. K. Walters
Clarion	C. F. Huff
	C. P. McCalmont
	George E. Wearing
Clermont	W. A. Hovis
Connellsville	J. E. Angle
	C. J. Poole
	William Richter
Coraopolis	J. J. Ewing
Corry	G. M. Stafford
	W. E. Wilson
Coudersport	F. A. French
Crafton	Clark Knox
Donora	J. H. Leathers
DuBois	Harry M. McCandless

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Pennsylvania — Continued.

Dubois	F. M. Michel
	L. M. Simmons
East Brady	C. E. Cummings
East Pittsburgh	Thomas C. Clifford
	A. G. Holmes
Elderton	J. L. Silverling
Elkland	T. A. Fessler
Emlenton	C. E. Grant
Erdice	H. E. Nelson
Erie	Larmour Adams
	B. H. Donovan
	E. J. Germer
	Otto G. Hitchcock
	F. D. Krum
	Charles J. Prior
	Henry P. Westcott
Ford City	J. A. W. Miller
Franklin	G. K. Bigler
	C. J. Crawford
Galeton	P. E. Crowl
Glenshaw	J. M. Kay
	J. C. Titzel
Glenwillard	Frank Lackey
Greensburg	J. M. Klingensmith
	Earle Pick
Greenville	A. C. Hartzell
Grove City	E. W. Jordan
Hallton	R. E. Benninger
Halsey	S. T. Murphy
Harmony	E. H. Hutchinson
Harveys	D. L. Stokes, Jr.
Homestead	H. L. Smith
Indiana	W. A. Bartley
Johnstown	P. J. Morissey
Kane	C. H. Adams
	E. W. Aggers
	L. C. Amey
	J. A. Henning
	John Leonard
	H. H. Marquis
	R. J. Williams
Kittanning	John Crossett
Latrobe	William Heazlett
	S. T. Shaw

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Pennsylvania — Continued.

Lodlow	Dennis O'Leary
McKeesport	M. J. Garrity
Mapleton	George B. Vance
Marwood	M. B. Cypher
Mayport	J. F. Anderson
Mayerstown	George W. Schell
Meadville	F. A. Fairchild
	P. L. Mulkin
	F. V. Stein
Mercer	J. W. Ayer
Midland	J. H. Fonner
Midway	C. R. Ballard
Monessen	M. C. Crum
Mt. Jewett	C. H. Russell
Mt. Morris	Robert Shear
Mt. Oliver	J. S. Hildabrand
Murraysville	W. S. King
	F. M. Sloan
New Bethlehem	Arthur C. Fleming
New Castle	J. T. Campbell
New Kensington	George M. Evans
	E. E. Myers
Oakmont	J. S. McMunn
Oil City	N. H. Benninger
	E. R. Boyle
	Patrick C. Boyle
	Fred N. Chambers
	H. V. Couch
	W. P. Craig
	James B. Crawford
	Raymond Cross
	H. M. Ernst
	C. W. Gleason
	L. L. Graham
	John F. Mason
	C. E. Oliver
	C. A. Pearson
	F. Sartorius
	Joseph Seep
	John Tonkin
	W. O. Walker
	R. W. Ward
	Henry P. Wege
	T. R. Weymouth
	William T. Young

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Pennsylvania — Continued.

Philadelphia	Henry S. Battin
	Samuel T. Bodine
	Walton Clark
	W. F. Douthirt
	R. A. Field
	C. Willing Hare
	Robert C. James
	J. B. Klumpp
	Lewis Lillie
	John D. McIlhenny
	Rollin Norris
	Paul Thompson
Pittsburgh	A. L. Abramovitz
	H. L. Applegate
	A. A. Armstrong
	W. H. Arnold
	W. H. Arras
	Louis F. Barger
	E. O. Bartless
	John C. Bartlett
	E. O. Bartlett
	E. L. Bartley
	G. F. Batchelor
	R. D. Beardsley
	George K. Benner
	O. Bieler
	J. E. Billingsley
	Arthur Booth
	C. J. Braun, Jr.
	A. L. Brenner
	George R. Brink
	D. J. Brown
	Louis Brown
	H. K. Bragdon
	James I. Buchanan
	S. E. W. Burnside
	George A. Burrell
	H. W. Burson
	J. B. Cappeau, Jr.
	W. B. Carson
	William C. Chaplin
	W. B. Chapman
	James Clark

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Pennsylvania — Continued.

Pittsburgh	Robert E. Clark
	W. G. Cole
	Eugene F. Conners
	W. F. Corcoran
	John B. Corrin
	Albert B. Craig
	George W. Crawford
	G. A. Crosby
	W. G. Cummings
	R. H. Cunningham
	A. B. Dally
	Harvey N. Dauler
	A. P. Davis
	Leslie B. Denning
	William C. Edwards
	E. J. Egan
	C. D. Evans
	F. I. Falk
	Otto F. Felix
	H. H. Fisher
	A. J. Fitzgibbon
	T. B. Foley
	T. H. Foley
	L. C. Frohrieb
	J. B. Garver
	John Gates, Jr.
	John E. Gill
	J. R. Goldsborough
	A. R. Gray
	William T. Griswold
	F. D. Grunder
	Joseph F. Guffey
	E. F. Gwynn
	F. L. Hadley
	W. R. Hadley
	C. T. Hall
	Robert W. Hannan
	Ralph W. Hay
	J. H. Healy
	F. P. Hegerty
	M. H. Henning
	H. D. Hildabrand
	Dudley M. Hill
	J. B. Hill

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Pennsylvania — Continued.

Pittsburgh	D. O. Holbrook
	E. D. Ivory
	C. W. Johnson
	Roswell H. Johnson
	Russell A. Johnson
	J. E. Keenan
	J. J. Kennedy
	A. N. Kerr
	James King
	George T. Ladd
	Robert Law, Jr.
	Miles B. Layton
	Harry M. Leathers
	E. D. Leland
	R. M. Leland
	Frank O. LeRoy
	F. C. Leslie
	M. R. Marple
	J. O. Martin
	John G. McCabe
	C. H. McCandless
	Joseph McClellan
	W. L. McCloy
	R. A. McCrea
	G. W. McCullough
	Jesse Clark McDowell
	George R. McKee
	William McKee
	R. A. McKinney
	J. I. McNally
	S. W. Meals
	C. A. Machesney
	Edwin C. Merrill
	Carroll Miller
	Dalton F. Miller
	R. R. Miller
	Fred W. Miner
	C. S. Mitchell
	Edgar M. Moore
	Lee C. Moore
	P. A. Moran
	John J. Murray
	A. J. Newman
	Thomas Nicoll

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Pennsylvania — Continued.

Pittsburgh	C. O. Nordensen
	John Ostermaier
	J. E. Parsons
	A. B. Patterson
	William M. Patterson
	Christy Payne
	James G. Pew
	John G. Pew
	C. E. Porter
	Charles E. Pratt
	S. C. Preston
	H. A. Quay
	William S. Ralston
	Harvey Rankin
	George W. Ratcliffe
	J. A. Reed
	James H. Reed
	J. H. Reed, Jr.
	E. B. Reeser
	George N. Riley
	D. Robertson
	James D. Robertson
	H. P. Roby
	M. Romano
	E. S. Rooney
	Willard J. Rowland
	C. H. Rupp
	Louis C. Sands
	John H. Schalck
	W. F. Schell
	M. C. Schneider
	J. R. Shattuck
	J. W. Shay
	John C. Sheppard
	J. M. Simpson
	Elmer A. Smith
	H. C. Smith
	W. H. Spain
	W. A. Sprenkle
	A. E. Staniek
	S. B. Stewart
	William Stewart
	George J. Stuart
	T. O. Sullivan

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Pennsylvania — Concluded.

Pittsburgh	J. Roy Tanner
	Edgar Thomas
	Adam Tomer
	John B. Tonkin
	Ellis M. Treat
	J. C. Trees
	William B. Way
	Howard W. Wentzel
	E. P. Whitcomb
	William Whiteley
	J. B. Wikoff
	George Wittmer, Jr.
	Henry Wittmer
	Thomas Wittmer
	R. B. Woodworth
	W. H. Young
	C. W. Zimmerman
Port Allegany	T. A. Dunn
	J. W. Farner
	R. B. Flint
	D. H. Phillips
	W. H. Richards
Portage	J. A. Sloan
Reynoldsville	C. O. Berg
Ridgeway	C. H. Law
Roulette	L. E. H. Brown
	William A. Ditto
Saint Marys	Philip Dixon
Saxonburg	Emil Rudert
Sewickley	John J. O'Day
Sharon	J. P. Curry
Sharpsburg	S. H. Eastland
Shinglehouse	B. F. Goble
	W. M. Holly
	J. H. Isherwood
	A. J. Schlosser
Smithfield	George B. Meredith
Smethport	Peter Fay
	Louis E. Sterrett
South McConnellsville	William F. Richter
Tarentum	L. V. Silliman
Ten Mile Bottom	F. A. Cross
Titusville	D. M. Donehue
	George F. Fleming

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Pennsylvania — Concluded.

Titusville	**W. T. Funk**
	Robert S. Hampton
Uniontown	F. L. Garard
	H. D. Hutchinson
	L. L. Miller
Van	J. P. Mansfield
Warren	W. B. Clawson
	George W. Hickernell
	Donald W. Mackie
	H. H. McConnell
	H. M. Prill
	C. T. Sloan
	L. L. Wood
Washington	George F. Drury
	A. D. Kightlinger
	J. W. Leonard
	Henry Martin
	William O'Brien
	Hose Schaffer
	W. P. Simmons
	Patrick Yorke
Waynesburg	C. E. Dittman
	J. L. Fye
	John Glass
	W. E. Nestor
	Albert Rush
	P. A. Troutman
Westfield	A. A. Presho
Wilkinsburg	W. G. Ketler
	J. W. Kidd
	George A. Kinley
	J. A. Lambing
	Harry Porterfield
	William Reichert
Woodlawn	Arthur McClellan

Rhode Island

Providence	George S. Barrows

Texas

Atlanta	William E. Sipe
Corpus Christi	D. C. DeWitt
	C. A. Schwarm
Corsicana	E. R. Brown

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Texas — Concluded.

Dallas	J. E. Hutchinson
	Henry C. Morris
	R. G. Soper
Denison	T. W. H. Flinn
	S. F. McCluney
Fort Worth	L. E. Barrows
	Frank L. Chase
	W. P. Gage
	D. P. Harrington
	F. W. Kirk
	Fred M. Lege, Jr.
	O. K. Shannon
Gainesville	W. E. Milne
Groesbeck	R. L. Underwood
Laredo	M. P. Cullinan
Mexia	E. J. Anderson
Moran	H. W. Brennan
	Joseph Merket
Petrolia	C. M. Baker
Port Arthur	J. S. Connelly
Texarkana	L. K. Whitehead
	W. L. Wood, Jr.
Thurber	E. J. Marston

West Virginia

Branchland	L. P. McAllister
Bridgeport	French Nicholson
Charleston	R. G. Altizer
	George R. Carpenter
	Frank Cox
	C. S. Duffield
	J. E. Frazier
	William Freudenberger
	F. P. Grosscup
	Paul B. Grosscup
	George T. Hennessey
	D. C. Jay
	D. A. Ketchum
	Robert Lockhart
	W. C. Marckworth
	C. O. McDowell
	R. N. Parks
	J. W. Penhale
	J. L. Perdue

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West Virginia — Continued.

	Edward Sackett
	L. A. Seyffert
	P. C. Sloane
	A. C. Smith
	George E. Taylor
	H. A. Wallace
	James B. Weir
	W. W. Wolfe
Clarksburg	W. F. Alexander
	David J. Carter
	H. C. Cooper
	Filmore C. Devericks
	R. F. Dolen
	J. J. Evans
	I. D. Frantz
	Wallace B. Gribble
	Boyd E. Horner
	Lynn S. Horner
	Howard Jenkins
	L. G. Kincheloe
	W. C. McMasters
	J. F. McNary
	John Mowrey
	T. B. Peddicord
	Ernest Randolph
	Charles C. Reed
	Bert Singleton
	H. L. Snyder
	Olandus West
	John H. Williams
Clendenin	T. R. Cartwright
	L. V. Koontz
	John McMillen
Dawes	A. R. Rich
Fairmont	Curtis B. Fleming
	G. H. Jackson
	F. B. Pryor
	Edwin Robinson
	Lon Lavell
Farmington	T. W. Engle
Grafton	C. W. Boocks
Hastings	Roy Glass
Hundred	T. J. White
Huntington	D. E. Abbott

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West Virginia — Continued.

Huntington	E. G. Burns
	O. L. Davis
	G. I. Gassdorf
	E. J. Greenawalt
	E. J. King
	J. T. McClintock
	James McCloskey
	John J. Nash
	Raymond J. Nash
	G. A. Northcott
	J. W. Reeser
Kenova	Deo Jimerson
Kermit	R. C. Leard
Littleton	J. P. Campbell
	R. J. Clarkson
McWhorter	W. J. Droppleman
Mannington	Claude M. Fleming
	R. B. Howard
	Thomas J. Jones
	W. T. Smith
Middlebourne	T. C. Kingsley
Morgantown	A. T. Casto
	D. H. Courtney
	D. F. Dusenberry
	Jesse J. Hall
	W. E. Hunter
	C. R. Jones
	W. H. South
	Israel C. White
Moundsville	F. O. Funk
	George M. Luther
	W. K. Mason
Parkersburg	T. P. Burns
	J. T. Callanan
	David B. Cradford
	John M. Crawford
	Herman D. Hogg
	A. E. Kenney
	Virgil P. Kline
	Edward B. Rich
	Wade H. Tonkin
	E. W. Williams
Peytona	C. L. Short
Ranson	John B. Brazier

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West Virginia — Concluded.

Saint Albans	R. N. Sargent
Saint Marys	A. I. Sutton
Salem	M. L. Campbell
	J. E. Frainer
	J. K. Swartz
Sharon	J. P. Curry
Sistersville	J. W. Cushing
	F. W. Martin
Smithville	David White
Spencer	J. E. Geist
	J. F. Geist
	A. S. Heck
	Thomas F. O'Brien
Weston	Henry Brewster
	Carl C. Dunham
	George L. Hinerman
	James J. Logue
	Edward P. McCall
	H. J. McGilvary
	L. J. McNary, Jr.
	William L. Sheets
	J. W. Taylor
	W. A. Williams
West Union	P. S. Hazlett
	John C. Stitt
Wheeling	John Duncan
	A. S. Hare
	Paul Luebecker
	J. F. Nestor
	George B. Riddle
Wilsonburg	Charles Cavenau

Wisconsin

Milwaukee	A. O. Rutz
	J. C. Wilson

CANADA

Alberta

Calgary	R. L. Bevan
	Dillon Coste
	Eugene Coste
	Stuart W. Davies
	F. J. Heuperman
	W. E. Larkham

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